

# Radio- Electronics

COMPUTERS - VIDEO - STEREO - TECHNOLOGY - SERVICE

SPECIAL SECTION  
VIDEO ENTERTAINMENT

DEC. 1982

\$1.25

Build this  
**COMMERCIAL EDITOR**  
for your VCR

Special Section  
**VIDEO ENTERTAINMENT  
IN THE HOME**

- ★ The Entertainment Center
- ★ Direct-To-Home Satellite Service
- ★ New Video Components
- ★ Video Signal Processors
- ★ How to Connect Video Components

How to  
**ETCH PC BOARDS**  
at home

Back-to-school series  
**MULTI-STAGE  
AMPLIFIERS**

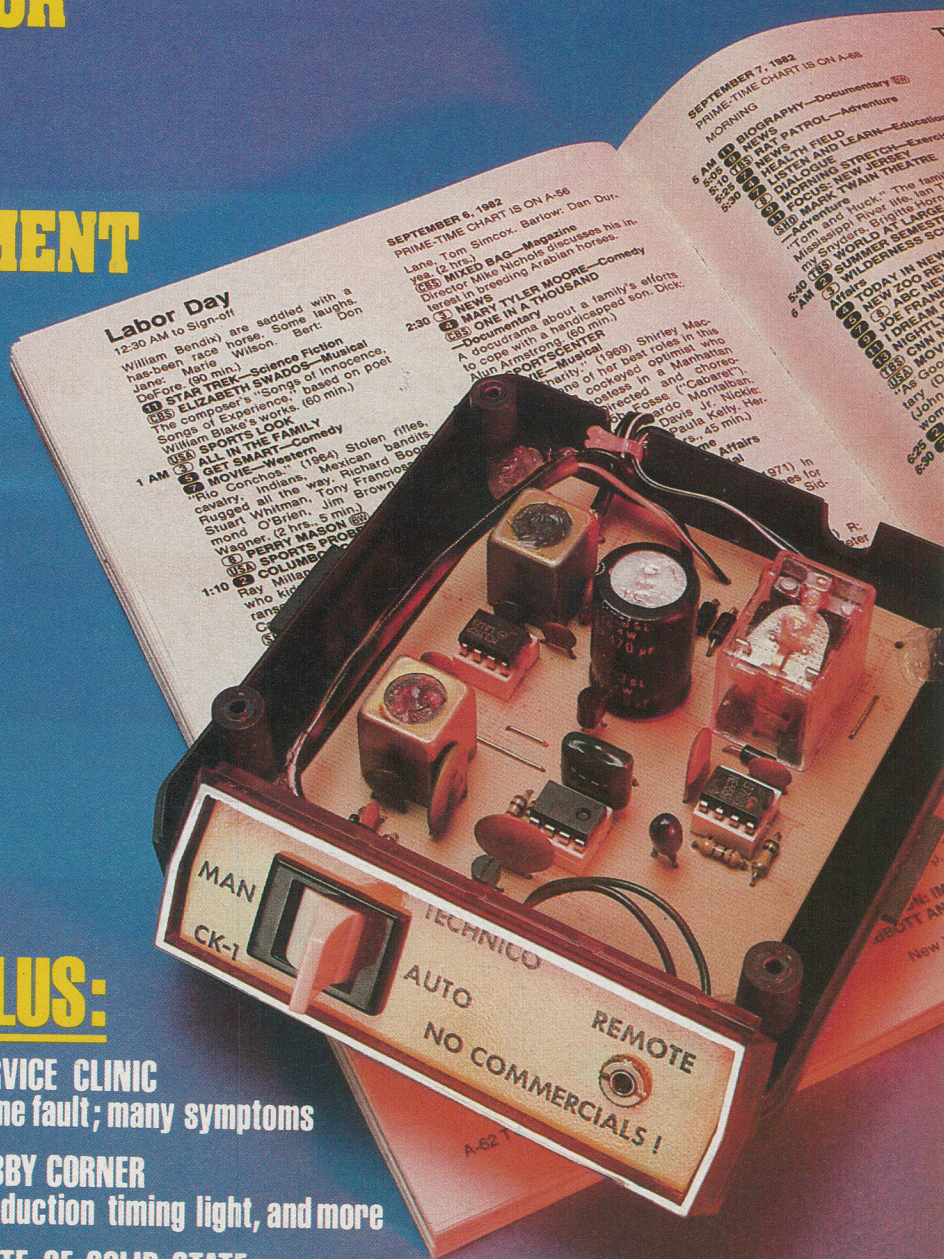
**PLUS:**

**SERVICE CLINIC**  
One fault; many symptoms

**HOBBY CORNER**  
Induction timing light, and more

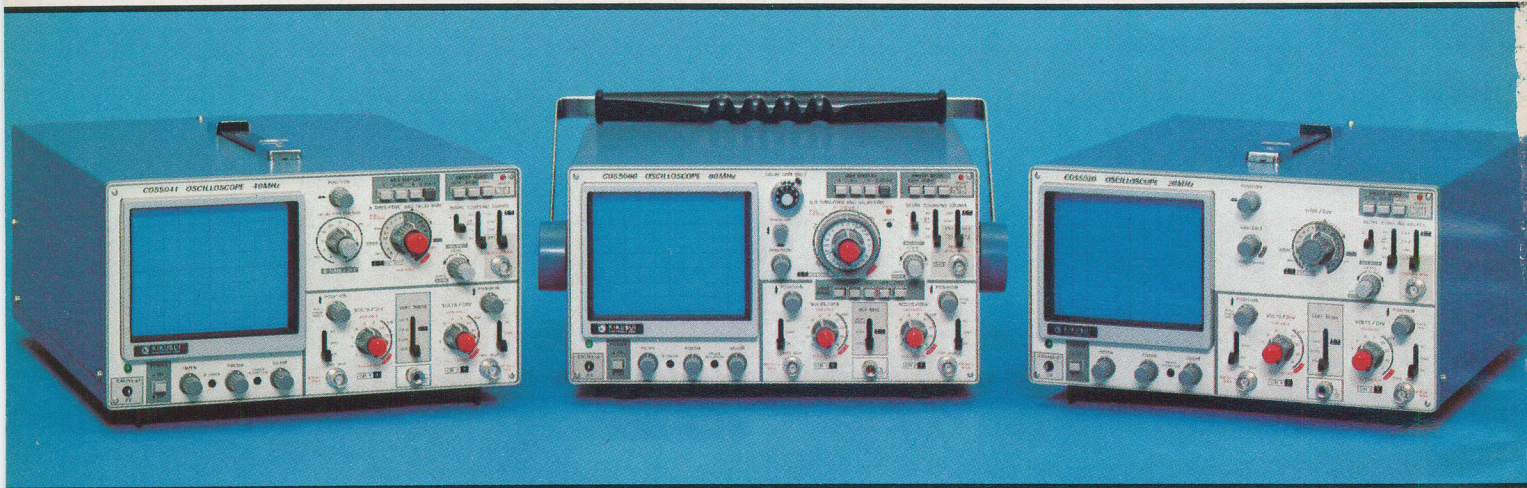
**STATE-OF-SOLID-STATE**  
Humidity sensors

**EQUIPMENT REPORTS**





# The best 60MHz scope costs only \$1100. It's from Kikusui.



That's right. Only \$1100 for Kikusui's top-of-the-line 5060 model oscilloscope. And we also have four other scopes for as low as \$600 in our new 5000 Series.

Not only that, we're offering a two year warranty on each of them, compared to other big name companies' limited one year warranties.

When it comes to performance, our 5000 Series has the edge over the Tektronix 2200 Series in lab quality, chop frequency, and trigger view. Ours also have more display modes, higher acceleration for better brightness, and sharper focus for better resolution.

Each scope in our 5000 Series is crafted so that it can be used for production, field service, consumer electronics servicing, or even personal use. The 5060 is a 60MHz scope with 3 channels, eight traces, delayed sweep, delay line and alternate sweep, and priced at \$1100. Models 5040 and 5041 are 40MHz, dual channel scopes, featuring peak-to-peak automatic triggering, automatic focus control and a delay line. If you're interested in a 20MHz scope, we have our 5020 and 5021 models with features similar to our 40MHz scopes. Both the 5041 and 5021 also have delayed sweep. Prices at \$920 for the 5041, \$795 for the 5040, \$690 for the 5021 and \$595 for the 5020. So, whatever model suits you best, you can't get a better scope for the money.

Of course, there's a reason we're able to offer these bargains and quality. We're one of the biggest manufacturers of scopes in the world, with over 30 years in the business. Another reason is KIK's nationwide network of lab quality maintenance facilities.

Write us and we'll send complete specifications back to you. Or just take a little time to call us. It's a small price to pay to get big time quality and service.

For sales and technical information  
call toll free **800-421-5334**  
(in Calif., Alaska, Hawaii 213-515-6432).

Order Toll Free  
**800-421-5334**



17819 Figueroa Street  
Gardena, Calif. 90248  
TWX 910-346-7648

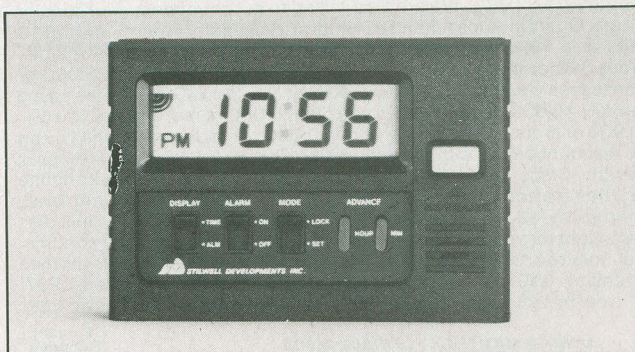


In Canada call: Interfax Systems, Inc. 514-366-0392

Subsidiary of Kikusui Electronics Corp., 3-1175 Shinmaruko-Higashi, Nakaharu-Ku, Kawasaki City, Japan (044) 411-0111







# SleepSafe

**Gives you a SMOKE DETECTOR...  
an ALARM CLOCK...  
an EMERGENCY BEACON...  
and a portable FLASHLIGHT  
all in one compact unit.**

The news flash broke. "Tragic fire in Las Vegas kills over 100 people sleeping in their hotel rooms." The fire alarms didn't work! It was a tragic event; those poor people never were awoken. They simply never had a chance.

The statistics aren't pleasant, they're shocking! 700,000 homes, hotels and hi-rises go up in flames every year. SLEEPSAFE can improve your odds.

Not only does SLEEPSAFE protect you everywhere, but it's completely portable and needs no wires or installation.

SLEEPSAFE stores compactly in its own case. Detects smoke and wakes you with a piercing 85-decibel alarm. It's extremely sensitive but specially designed to minimize false alarms. Battery operated — (batteries included) completely independent of any outside power source.

SLEEPSAFE also contains its own slide-out, slide-in, five function LCD Modular Alarm Clock. The digital readout includes alarm, snooze-alarm and backlite. Battery operated (batteries included).

SLEEPSAFE contains an emergency beacon light, which automatically lights during emergencies, and helps point the way to safety. The light stays on until the air is cleared, it can also be manually turned on or off.

Try one, there's no risk. Send your check or money order for **\$39.95** plus \$3.00 postage and handling. (Illinois residents add 6% sales tax.) Only credit card buyers can use the toll-free number given below. Guaranteed quick delivery.

We'll ship you your SLEEPSAFE within one week of our receiving your order or we'll pay the shipping.

If, for any reason, whatsoever, you're not 100% satisfied, just return it in its original box for a courteous refund.

SLEEPSAFE is inexpensive enough to put one in every sleeping room in your home — especially covering the children's rooms, SLEEPSAFE gives you peace-of-mind for older folks, too, the handicapped...college dorm students...any loved one at home or away. It's simply the most practical, helpful traveling companion you'll ever take along.

SLEEPSAFE is an ideal Christmas gift. One that will make both you and your loved ones sleep easier, order a SLEEPSAFE today.

## SEI

CONSUMER PRODUCTS DIVISION

912 West Touhy Avenue, Park Ridge, IL 60068

Call Toll Free (Orders Only) ..... (800) 323-1327  
For Information Call ..... (312) 564-0104

**PRODUCTS OF  
THE FUTURE  
TODAY**



CIRCLE 14 ON FREE INFORMATION CARD



**Why use other computer media  
when you could be using**

# MEMOREX

**high quality error free media?**

## Free Memorex Mini-Disc Offer - Get free discs!

You'll save money when you buy Memorex, because every carton of 10 Memorex 5 1/4 inch mini-discs sold by Communications Electronics has a coupon good for a free Memorex mini-disc. For every case of 100 Memorex mini-discs you buy from CE, you'll get 10 free Memorex mini-discs, directly from Memorex. The more you order, the more you save. Offer expires December 31, 1982. All Memorex flexible discs sold by CE are of the highest quality, certified 100% error free and backed by a full one year factory warranty.

## Flexible Disc Quantity Discounts Available

Memorex Flexible Discs are packed 10 discs to a carton and 10 cartons to a case. Please order only in increments of 100 units for quantity 100 pricing. We are also willing to accommodate your smaller orders. Quantities less than 100 units are available in increments of 10 units at a 10% surcharge. **Quantity discounts** are also available. Order 500 or more discs at the same time and deduct 1%; 1,000 or more saves you 2%; 2,000 or more saves you 3%; 5,000 or more saves you 4%; 10,000 or more saves you 5%; 25,000 or more saves you 6%; 50,000 or more saves you 7% and 100,000 or more discs earns you an 8% discount off our super low quantity 100 price. Almost all Memorex Flexible Discs are immediately available from CE. Our warehouse facilities are equipped to help us get you the quality product you need, when you need it. If you need further assistance to find the flexible disc that's right for you, call the Memorex flexible disc compatibility hotline. Dial toll-free 800-538-8080 and ask for the *flexible disc hotline* extension 0997. In California dial 800-672-3525 extension 0997. Outside the U.S.A. dial 408-987-0997 between 9 AM to 4 PM Pacific Time.

### SAVE ON MEMOREX FLEXIBLE DISCS

Product Description	Part #	CE quant. 100 price per disc (\$)
8" SSSD IBM Compatible (128 B/S, 26 Sectors)	3062	2.09
8" SSSD Shugart Compatible, 32 Hard Sector	3015	2.09
8" SSSD CPT 8000 Compatible, Soft Sector	3045	2.99
8" SSSD IBM Compatible (128 B/S, 26 Sectors)	3090	2.74
8" DSDD Soft Sector (Unformatted)	3102	3.34
8" DSDD Soft Sector (128 B/S, 26 Sectors)	3115	3.34
8" DSDD Soft Sector (256 B/S, 26 Sectors)	3103	3.34
8" DSDD Soft Sector (512 B/S, 15 Sectors)	3114	3.34
8" DSDD Soft Sector (1024 B/S, 8 Sectors)	3104	3.34
5 1/4" SSDD Soft Sector w/Hub Ring	3481	2.34
5 1/4" SSDD 10 Hard Sector w/Hub Ring	3483	2.34
5 1/4" SSDD 16 Hard Sector w/Hub Ring	3485	2.34
5 1/4" DSDD Soft Sector w/Hub Ring	3491	3.09
5 1/4" DSDD 10 Hard Sector w/Hub Ring	3493	3.09
5 1/4" DSDD 16 Hard Sector w/Hub Ring	3495	3.09
5 1/4" SSQD Soft Sector w/Hub Ring (96 TPI)	3504	2.99
5 1/4" DSQD Soft Sector w/Hub Ring (96 TPI)	3501	3.99

SSSD = Single Sided Single Density; SSDD = Single Sided Double Density; DSDD = Double Sided Double Density; SSQD = Single Sided Quad Density; DSQD = Double Sided Quad Density; TPI = Tracks per inch.

## Special offer on Memorex computer tape.

If you mail your order to us and enclose prepayment, deduct \$1.00 per reel from our quantity 100 prices. This means Memorex 25JW can be as low as \$12.99 in 100 quantities. Memorex Computer Tapes are packed 10 tapes to a carton. Please order only in increments of 100 units for quantity 100 pricing. Quantities less than 100 units are available in increments of 10 units at a 10% surcharge. **Quantity discounts** are also available. Order 500 or more tapes at the same time and deduct 1%; 1,000 or more saves you 2%; 2,000 or more saves you 3%; 3,000 or more saves you 4%; 4,000 or more saves you 5% and 5,000 or more tapes earns you a 6% discount off our super low quantity 100 price. If you need further assistance or information to find the tape that's right for you, call the Memorex Computer Tape Technical Support Group at (408) 987-2937.

### SAVE ON MEMOREX COMPUTER TAPE

Product Description	Part #	CE quant. 100 price per reel (\$)
Memorex IV 2400 feet Wrightline Seal	25JW	13.99
Memorex IV 2400 feet Easy Load II Cartridge	25JR	14.99
Memorex IV 1200 feet Wrightline Seal	25FW	10.65
Memorex Quantum 2400 feet Wrightline Seal	27JW	16.20
Memorex Quantum 2400 feet Easy Load II Cart.	27JR	16.99
Memorex Quantum 1200 feet Wrightline Seal	27FW	12.50
Memorex Cubic HD 2400 feet Wrightline Seal	39JW	18.99
Memorex Cubic HD 2400 feet Easy Load II	39JR	19.99
Memorex Cubic HD 1200 feet Wrightline Seal	39FW	13.99

## New Memorex Lifetime Rigid Disc Pack Product Warranty

All Memorex disc packs sold by CE have a lifetime product warranty. This is your assurance that Memorex disc packs will give you a lifetime of performance and service. Only Memorex can offer you the superior reliability of their exclusive M Formula. In addition, Memorex will assist the original user in isolating and correcting any technical issues that relate to the Memorex product as well as, when appropriate, replace up to one set of read/write heads. If you need further information to find the rigid disc that's right for you, call the Memorex rigid disc compatibility hotline. Dial toll-free 800-538-8080 and ask for the *rigid disc hotline* extension 1642. In California dial 800-672-3525 extension 1642. Outside the U.S.A. dial 408-987-1642.

### SAVE ON MEMOREX RIGID DISC PACKS

Product Description	Part #	CE quant. one price per pack (\$)
Mark III 5 MB. Cartridge Front Load (8 to 32 Sect.)	95-522XX-03	65.00
Top Load (1-to 24 sectors)	94-522XX-03	70.00
CMD-16 "Phoenix Type" CDC Cartridge	98-26600-31	160.00
NCR Cartridge	98-26600-32	160.00
Mark VIII 80 MB. Error Free	72-16600-03	330.00
Flag Free	72-26600-03	320.00
Mark XI 200 MB. Error Free	03-35041	720.00
Flag Free	03-35031-02	560.00
DEC Flag Free	03-35031-03	560.00
Mark XII 200 MB. NCR/CDC Flag Free	03-39001-01	515.00
Honeywell Flag Free	03-39000-01	515.00
Mark XIII 300 MB. Error Free	03-47021	795.00
Flag Free	03-47009	670.00
Mark XIV 80 MB. Unformatted Error Free	74-16600-03	365.00
Flag Free	74-26600-03	300.00
Honeywell Format Flag Free	74-26600-08	315.00
CDC Format Flag Free	74-26600-09	315.00
Mark XV 300 MB. Error Free	03-49011	825.00
Flag Free	03-49001-01	725.00

## Smith-Corona TP-1 Letter Quality Printer Special Offer

Buy any Memorex product on this page, and get a Smith-Corona TP-1 letter quality printer for only \$585.00 plus \$20.00 shipping. Specify serial or parallel version.

## Buy with Confidence

To get the fastest delivery from CE of your Memorex computer products, send or phone your order directly to our Computer Products Division. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 30% surcharge for net 30 billing. All sales are subject to availability, acceptance and verification. All sales are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Minimum prepaid order \$50.00. Minimum purchase order \$200.00. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

**For shipping charges** add \$8.00 per case or partial-case of 100 8-inch flexible discs or \$6.00 per case or partial case of 100 5 1/4-inch mini-discs. For tape shipping, add \$1.00 per reel. For Disc packs add \$10.00 per cartridge (Mark III or CMD-16) or \$15.00 per disc pack for U.P.S. ground shipping and handling in the continental U.S.A.

**Mail orders to:** Communications Electronics, Box 1002, Ann Arbor, Michigan 48106 U.S.A. If you have a Master Card or Visa card, you may call and place a credit card order. Order toll-free. Dial 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. Order your Memorex computer products from CE today.

Copyright ©1982 Communications Electronics™

Ad #090282



**Order Toll-Free!**  
**(800) 521-4414**  
In Michigan (313) 994-4444

**MEMOREX**

COMPUTER TAPE  
DISC CARTRIDGES RIGID DISCS  
FLEXIBLE DISCS

**COMMUNICATIONS  
ELECTRONICS™**

**Computer Products Division**

854 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.  
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

CIRCLE 12 ON FREE INFORMATION CARD



## SPECIAL FEATURES

- 51 VIDEO ENTERTAINMENT
- 52 Video Entertainment in the home  
A. Lewis
- 55 Direct Broadcast Satellite Television.  
Danny Goodman
- 59 New Video Components.  
Danny Goodman
- 63 Video Accessories. Gordon McComb
- 67 How to Connect Video Components.  
Gary McClellan

## BUILD THIS

- 43 AUTOMATIC COMMERCIAL EDITOR  
Make commercial-free tapes of your favorite old black-and-white movies. Gary McClellan

## TECHNOLOGY

- 4 VIDEO ELECTRONICS  
Tomorrow's news and technology in this quickly changing industry. David Lachenbruch
- 10 SATELLITE/TELETEXT NEWS  
The latest happenings in communications technology.  
Gary Arlen
- 90 STATE OF SOLID STATE  
An all-electronic humidity meter. Robert F. Scott

## CIRCUITS AND COMPONENTS

- 47 ETCH YOUR OWN PC BOARDS  
Making your own PC boards is easier than you think. Here are step-by-step instructions from a master. Robert Grossblatt
- 75 HOW TO DESIGN ANALOG CIRCUITS  
Increasing circuit gain. Mannie Horowitz
- 84 NEW IDEAS  
Low-battery indicator.
- 100 HOBBY CORNER  
Readers to the rescue. Earl "Doc" Savage, K4SDS

## VIDEO

- 94 SERVICE CLINIC  
Ground-return problems. Jack Darr
- 94 SERVICE QUESTIONS  
R-E's Service Editor solves technicians' problems. Jack Darr

## COMPUTERS

- 80 COMPUTER CORNER  
Selecting an accounting package. Les Spindle

## EQUIPMENT REPORTS

- 26 MFJ Model 1020 Active Antenna
- 30 Sanwa LCD-900 Multimeter
- 32 Smith Corona TP-1 Daisy Wheel Printer
- 40 Non-Linear Systems TR-1 Signature Analyser

## DEPARTMENTS

- 136 Advertising Index
- 8 Advertising and Sales Offices
- 137 Free Information Card
- 20 Letters
- 103 Market Center
- 85 New Literature
- 98 New Products
- 8 Publisher's Letter
- 6 What's News

## SEASON'S GREETINGS

*The editors and staff  
of Radio-Electronics  
join in sending  
holiday greetings and  
our best wishes for  
a happy new year*

## ON THE COVER

If you like to tape those vintage black-and-white movies that show up late at night on TV—but don't like to tape the commercials that accompany them—this automatic commercial editor is for you! It watches the movie along with your VCR and, when a commercial turns up, stops the tape until the movie begins again. The result is a tape of the movie, and nothing else. It's easy to build, and will...literally...provide you with hours of pleasure. Get started building your own editor. Plans begin on page 43.

**Radio-Electronics**, (ISSN 0033-7862) Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Second-Class Postage Paid at New York, N.Y. and additional mailing offices. One-year subscription rate: U.S.A. and U.S. possessions, \$13.00, Canada, \$16.00. Other countries, \$20.50 (cash orders only, payable in U.S.A. currency.) Single copies \$1.25. © 1982 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

**Subscription Service:** Mail all subscription orders, changes, correspondence and Postmaster Notices of undelivered copies (Form 3579) to Radio-Electronics Subscription Service, Box 2520, Boulder, CO 80322.

A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.



# VIDEO ELECTRONICS

DAVID LACHENBRUCH  
CONTRIBUTING EDITOR

## STEREO TV HITS SNAG

The dream of stereophonic sound for television in 1983 vanished in a puff of hostile smoke when an industrywide committee studying the subject went back to the drawing board instead of recommending a system. Since 1979, a subcommittee of EIA's Broadcast TV Systems Committee has been examining and testing three proposed multichannel TV sound systems. Each of the systems—proposed by EIA of Japan, Telesonics Systems Inc., and Zenith Radio Co.—met the subcommittee's basic criteria: (1) Stereo sound quality comparable to FM stereo. (2) An additional "picture-related" sound channel for such uses as foreign-language translation. (3) Compatibility with existing monophonic-sound receivers.

The subcommittee completed its tests of the three systems on time, and its timetable called for it to select a system for recommendation to the FCC in mid-October. Everything was going according to plan when the subcommittee's steering committee met to tally members' votes for a system. However, it was confronted unexpectedly by a charge from Telesonics Systems that the tests were incomplete. Telesonics requested that the subcommittee reopen its record—and implicitly threatened legal action unless the subcommittee agreed. Accordingly, the subcommittee decided to reopen the entire subject to cover the Telesonics objection, as well as another problem. That new problem related to the discovery that most cable-TV systems would be unable to relay stereophonic sound under any of the systems, and, in fact, the presence of a stereo signal could disrupt the carriage of mono programs on cable by causing adjacent-channel interference.

The delay could be six months to a year, or longer—if the subcommittee ever completes its work at all. At press-time, the group was preparing to ask the FCC to hold off any action on the issue of multichannel TV sound until new tests could be completed. But the FCC staff had already prepared a proposal for issuance by the Commission to permit TV stations to choose any stereo sound system which would meet certain criteria—a so-called "marketplace" decision similar to the one that permitted any of a number of AM stereo systems, all mutually incompatible, to be broadcast simultaneously. (The AM stereo order resulted in such confusion that few stations bothered to add stereo, and set manufacturers held off making AM stereo receivers.) TV broadcasters and set makers are concerned that the FCC will issue its proposal for "marketplace" stereo TV standards (meaning no standard) before the subcommittee can complete its new tests. If such an order is proposed by the FCC, the subcommittee will be dissolved, in view of legal opinions that it would be unlawful for representatives of competing systems to meet while the FCC is considering the issue. No matter what happens, it now appears there will be a long delay, and if you want to hear stereo sound with your TV you'll have to tune to a PBS simulcast or go to Japan or Germany.

## BANK-BY-TV

The first major home banking and information system has been inaugurated commercially by Chemical Bank in the New York City area after a 10-month test in 200 homes. Chemical's *Pronto* system uses any home computer, a telephone modem, automatic phone dialer, and special program cartridge; the Bank will supply the entire receiving system (except the TV set), based on an *Atari 400* computer, at around \$500, but other home computers can be used.

Pronto customers, who pay a monthly fee of about \$10, are able to call up bank statements on their TV screens, transfer funds among different Chemical Bank accounts, pay bills by electronic fund transfer, and send electronic mail messages to other Pronto subscribers. The system plugs into a modular telephone jack and is connected to the bank's Tandem computer. Future services to be offered on the Pronto system include financial services such as portfolio management, teleshopping, educational courses, home budgeting, and security monitoring. Chemical hopes that its system will become nationwide, and has already presented seminars to 250 other banks and institutions.

The bank said that more than 250 major companies already are accepting electronic bill-payment via Pronto—including American Express, Master Charge, Visa, major oil companies, most department stores, Sears, utilities, insurance companies, and major New York landlords. In paying bills, Pronto users can specify regular monthly payments, and even which day of the month they wish bills to be paid. Privacy is assured by a triple-security system including household and personal ID numbers, as well as an individual password. Bank officials predicted that 10 million American households will have interactive devices attached to their TV sets by the end of the decade.

R-E



**"No one else gives you as many functions in a handheld DMM."**

**Now you can move up to Fluke."**

We've got great news for people who've been holding out for a high quality, high performance DMM at a moderate price: Fluke's new nine-function model D 804 is now available at select electronics supply stores.

With a suggested U.S. price of only \$249 and features you won't find in any other handheld DMM, the D 804 is an exceptional value. Here's why.

**Logic level and continuity testing:** A real time-saver for troubleshooting passive circuits in pcb's, cables, relay panels and the like. The D 804 has a switch-selectable audible tone and visual symbols to indicate continuity or logic levels.

**Direct temperature readings in °C:** Used with any K-type

thermocouple, the D 804 delivers fully-compensated readings in °C from -20°C to +1265°C, for checking heating and refrigeration systems.

**Peak hold feature captures transients:** A short-term memory in the D 804 captures and holds the peak reading of a motor starting current.

**And more:** 0.1% basic dc accuracy, conductance, 26 measurement ranges, battery, safety-designed test leads and a one year parts and labor warranty. A full line of accessories is also available to extend the measurement capabilities of your DMM.

Ask your dealer about the powerful, versatile D 804 and the rest of Fluke's new Series D line of low-cost digital multimeters.



**From the world leader in DMM's. Now we've designed one for you.**



Suggested U.S. list price  
technical data circle No. 6  
RE 12/82 - D804

If your dealer doesn't carry Series D  
Multimeters yet, call this number. We'll be  
happy to tell you who does. 1-800-426-0361

**FLUKE**  
®



# WHAT'S NEWS

## "Father of Television" is dead at age 93

Vladimir Kosma Zworykin died this past July 29, at the Princeton (NJ) Medical Center, just one day short of his 93rd birthday. Called "The Father of Television" by many, he always declined the honor, pointing out that hundreds had contributed to the art over many years. Invention, he said, is like building a ladder, and that as each engineer added a rung, "It enabled the others to climb a little higher and see the next problem a little better."

The development of modern television, however, is based on Zworykin's steady work from the 1920's onward, especially his invention of the iconoscope, the first practical camera tube.

Dr. Zworykin was born July 30, 1889, in Mourom, Russia. He attended the Petrograd Institute of Technology, receiving an Electrical Engineering degree in 1912. At the Institute he studied under Professor Boris Rosing, and was his lab assistant. Rosing believed as early as 1908 that the cathode-ray tube was the solution to practical television. Dr. Zworykin, who credits both his decision to become a scientist and his special interest in television to Boris Rosing's influence, followed that line of reasoning in his work on the iconoscope and kinescope.

Dr. Zworykin joined RCA in 1929, serving as Director of the RCA Electronic Research Laboratory in Camden, NJ until 1942, and afterward at Princeton, until his retirement in 1954.

Besides television Dr. Zworykin was interested in a wide variety of subjects, ranging from gunnery controls through multiplier tubes to electronically controlled automobiles. For a number of years after his retirement, he directed the Medical Electronics Center at the Rockefeller Institute in New York, working for the development of electronics methods in medicine and the life sciences.

Zworykin received his doctorate from the University of Pittsburgh in 1926. In 1966, President Johnson awarded him the United States' highest honor, the National Medal of Science, "for major contributions to the instruments of science and television, and for stimulation of the application of engineering to medicine." Altogether, he received 27 major awards and much other recognition from groups throughout the world.

## Aircraft entertainment carried by infrared

A wireless-entertainment system using infrared light to carry the signal is being developed by the microelectronic systems division

of Hughes Aircraft Co. The new system is known as AIRES (Advanced Infra-Red Entertainment System). It uses a digital system transmitted throughout the plane by infrared rays. The signal is received and decoded by a headset worn by the passenger.

AIRES can transmit up to 16 channels. Each headset has a program-select and a volume control. A self-test feature assures that each unit remains in operating condition.

The use of infrared cuts the weight of the full system to less than half that of a conventional entertainment system, and the cost by one-third. Another great advantage of the infrared approach is that—unlike earlier wireless-entertainment systems—AIRES will not interfere with other aircraft equipment. It is expected that the new system will be on the market by the middle of 1983.

## KEYFAX, SSS Systems plan teletext magazine

KEYFAX Electronic Publishing and Satellite Syndicated Systems have announced that KEYFAX National Teletext Magazine will be ready for delivery to cable households shortly. This is stated to be the first large-scale teletext consumer operation in the United States, and is expected by its founders to grow to 200,000 cable households within 30 months.

The new teletext magazine will be delivered via the vertical blanking interval (VBI) of the WTBS satellite service, which is available to more than 20 million cable households.

The service will be offered to subscribers at a suggested \$19.90 per month. That covers \$9.95 for the service itself and \$9.95 for rent of the necessary decoder. Operators will retain \$3.95 per month as revenue (\$4.95 after penetration to 1 percent of their system's basic subscribers).

KEYFAX has been on the VBI of WFLD-TV in Chicago since April 1981, on a test basis. It has also been on the VBI of the WTBS satellite service since May 1982, and was displayed (via satellite and then through two TV stations) at the Knoxville World's Fair.

## N.J. State Police Improve their radars

The State Police of New Jersey have recently publicized their acquisition of "beam-interrupter" switches for their radar units. Those switches, when fitted to the devices, permit cutting off the radar beam without turning off the equipment. When a car suspected of speeding is sighted, the beam can be turned on instantly. If he has a radar detector, the speeder is not warned until police actually start taking a reading.

Manufacturers of radar detectors state that such a device is only minimally effective: "Once the officer activates the unit to obtain a speed reading on a vehicle, every detector-equipped motorist within its range will receive a warning. ... The beam will alert all detector-equipped vehicles within several miles."

The State Police believe that, in spite of any claimed deficiencies, the beam interrupters are effective, and point out as evidence of that effectiveness that manufacturers have begun to install the beam interrupters on new radars as a standard equipment.

## Video programs aid technical training

RCA's Corporate Engineering Education (CEE) unit at Cherry Hill, NJ, reports that a company-wide program of video courses has simplified the problem of keeping engineers, managers, and other technical personnel at RCA up to date on the very latest technological advances.

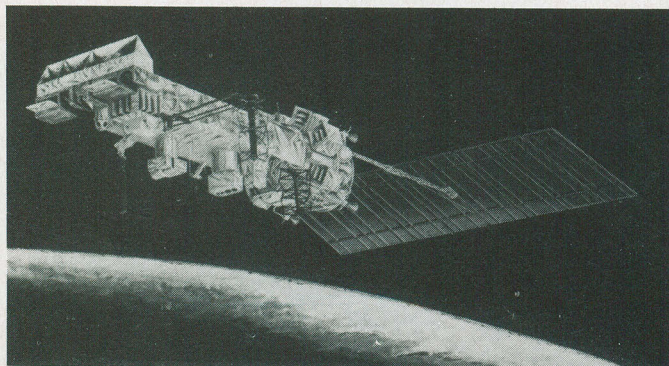
The company has recently begun to augment the video programs with live courses on subjects requiring extensive hands-on exercises and courses for small group projects.

Most video courses consist of 12 two-hour sessions, conducted as discussions, exercises, and hands-on activities supervised by an associate instructor.

In addition to the more than 70 video courses listed in CEE's catalog, CEE maintains a library of videotapes of technical seminars and talks; the library is maintained so that the tapes can be borrowed and viewed by RCA personnel at their convenience.

R-E

## NEW METEOROLOGICAL SATELLITE



TIROS-N (ATN) METEOROLOGICAL SATELLITE is the first of a series of advanced TIROS-N/NOAA meteorological satellites that is being designed and built for the National Oceanic and Atmospheric Administration (NOAA). In addition to its usual weather-charting duties, the satellite will be used to relay distress calls from the emergency beacons of downed aircraft and ships in distress. Launch is scheduled for February 1983. NASA will act as program manager for the mission.



# Now! A 60 MHz Tektronix scope built for your bench.

**Wide-range vertical sensitivity:**  
Scale factors from 100 V/div (10X probe) to 2 mV/div (1X probe). Accurate to  $\pm 3\%$ . Ac or dc coupling.

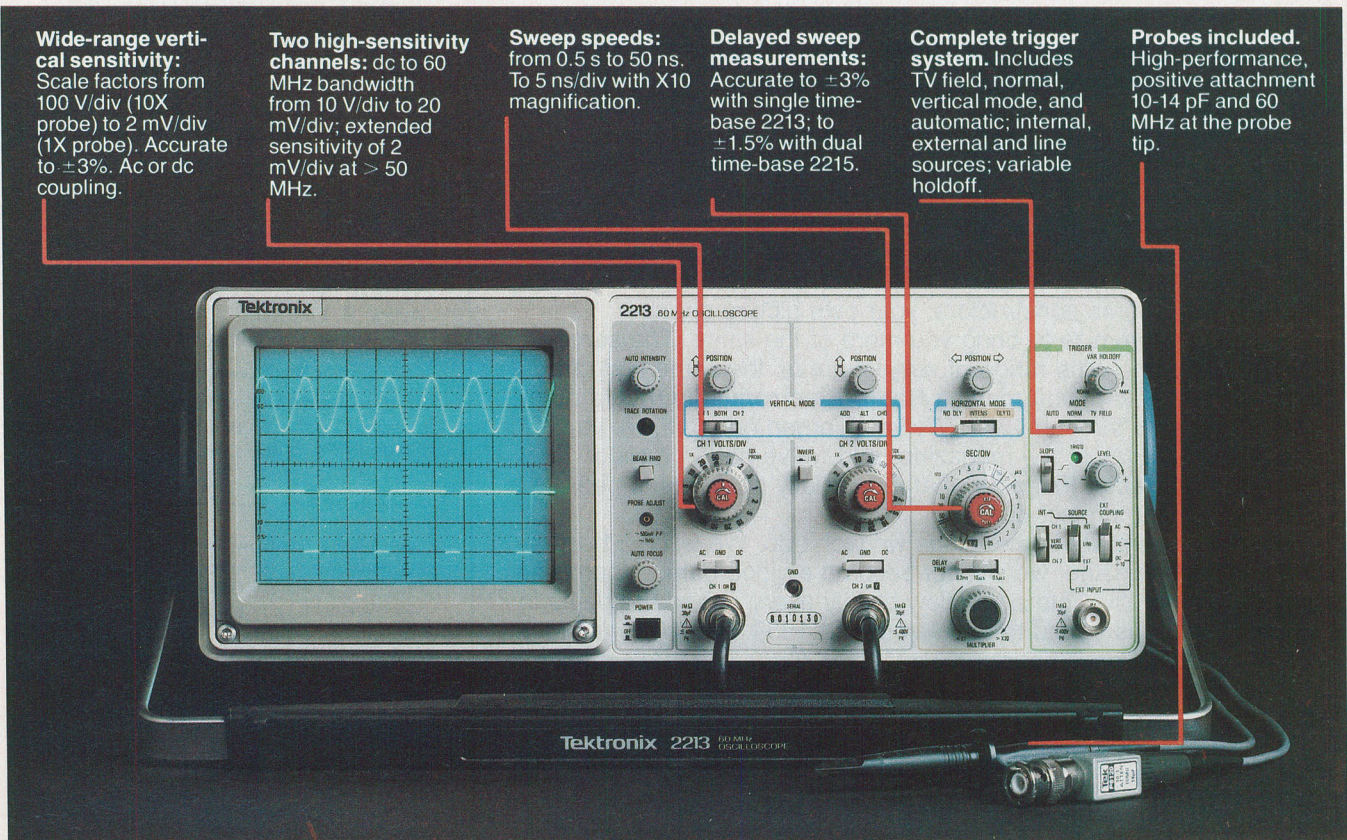
**Two high-sensitivity channels:** dc to 60 MHz bandwidth from 10 V/div to 20 mV/div; extended sensitivity of 2 mV/div at  $> 50$  MHz.

**Sweep speeds:**  
from 0.5 s to 50 ns. To 5 ns/div with X10 magnification.

**Delayed sweep measurements:**  
Accurate to  $\pm 3\%$  with single time-base 2213; to  $\pm 1.5\%$  with dual time-base 2215.

**Complete trigger system.** Includes TV field, normal, vertical mode, and automatic; internal, external and line sources; variable holdoff.

**Probes included.** High-performance, positive attachment 10-14 pF and 60 MHz at the probe tip.



**In 30 years of Tektronix oscilloscope leadership, no other scopes have recorded the immediate popular appeal of the Tek 2200 Series.** The Tek 2213 and 2215 are unapproachable for the performance and reliability they offer at a surprisingly affordable price.

There's no compromise with Tektronix quality: The low cost is the result of a new design concept that cut mechanical parts by 65%. Cut cabling by 90%. Virtually eliminated board electrical connectors. And obviated the usual cooling fan.

Yet performance is written all over the front panels. There's the bandwidth for digital and analog circuits. The sensitivity for low signal measurements. The sweep speeds for fast logic families. And delayed sweep for fast, accurate timing measurements.

**The cost: \$1200\* for the 2213. \$1450\* for the dual time base 2215.**

You can order, or obtain more information, through the Tektronix National Marketing Center, where technical personnel can answer your questions and expedite delivery. Your direct order includes

probes, operating manuals, 15-day return policy and full Tektronix warranty.

For quantity purchases, please contact your local Tektronix sales representative.

**ORDER TOLL FREE  
1-800-426-2200**

**Ask for Department J0147**  
In the state of Washington,  
Call (206) 253-5353 collect.

\*Price F.O.B. Beaverton, OR. Price subject to change.

**Tektronix**  
COMMITTED TO EXCELLENCE



# PUBLISHER'S LETTER

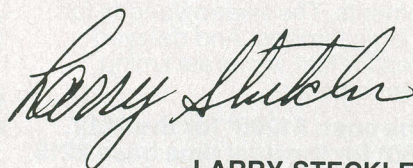
This December issue of **Radio-Electronics** magazine brings the year 1982 to a close. It has been an exciting one. We delivered four special sections during 1982—"Video Electronics" in January, "Your Own Computer" in April and again in October; plus a "Video Games" section in July. Along the way we were able to publish more than 150 articles covering a variety of subjects—audio, video, computers, radio, construction, how-to—to name just some of the varied areas we covered. We also logged a couple of exceptional construction stories—we showed how to build your own satellite TV receiver; and a first for home constructors: your own picture phone.

In 1983 we promise to bring you more of the same. The same quality, the same wide range of subject areas, the same first-rate electronics that kept you reading **Radio-Electronics** in record numbers all the way through 1982. We've enlarged our staff, we've added more pages to the magazine, and we've added a sister publication, **Special Projects**, that is specially designed to cater to the needs of the project builder.

However, there are some things we won't do. We will *not* become a computer magazine; we will *not* become a video-games magazine, and we will *not* dive into and follow blindly every one of the paths in electronics that is bound to develop during 1983. We *will* remain the broad-based, all-encompassing electronics magazine that we have been for the past 53 years. Each year we learn a little more, and that makes us better.

One bit of bad news, however—subscription prices are going up starting in January 1983. They are going up an average of \$2.00 per year. So if you want to save yourself a few dollars, use the subscription-order form in this issue—it's inside the back cover. Next month the prices on that card will be higher.

I'd like to thank you for your continued support and pledge that we will continue to do our very best to make **Radio-Electronics** the finest "electronics" magazine you read.



LARRY STECKLER  
PUBLISHER

## Radio- Electronics

Hugo Gernsback (1884-1967) founder  
M. Harvey Gernsback, editor-in-chief  
Larry Steckler, CET, publisher  
Arthur Kleiman, editor  
Josef Bernard, K2HUF, technical editor  
Carl Laron, WB2SLR, assistant editor  
Jack Darr, CET, service editor  
Robert F. Scott, semiconductor editor  
Herb Friedman, communications editor  
Gary H. Arlen, contributing editor  
David Lachenbruch, contributing editor  
Earl "Doc" Savage, K4SDS, hobby editor  
Dan Rosenbloom, production manager  
Robert A. W. Lowndes, production associate  
Stefanie A. Mas, production assistant  
Joan Roman, circulation director  
Arline R. Fishman, advertising coordinator

Cover photo by Robert Lewis

**Radio-Electronics** is indexed in *Applied Science & Technology Index* and *Readers Guide to Periodical Literature*.

Gernsback Publications, Inc.  
200 Park Ave. S., New York, NY 10003  
President: M. Harvey Gernsback  
Vice President: Larry Steckler

### ADVERTISING SALES 212-777-6400

Larry Steckler  
Publisher

#### EAST

Stanley Levitan  
Radio-Electronics  
200 Park Ave. South  
New York, NY 10003  
212-777-6400

#### MIDWEST/Texas/Arkansas/Okla.

Ralph Bergen  
The Ralph Bergen Co., Inc.  
540 Frontage Road—Suite 325  
Northfield, Illinois 60093  
312-446-1444

#### PACIFIC COAST Mountain States

Marvin Green  
Radio-Electronics  
413 So. La Brea Ave.  
Los Angeles, Ca 90036  
213-938-0166-7

#### SOUTHEAST

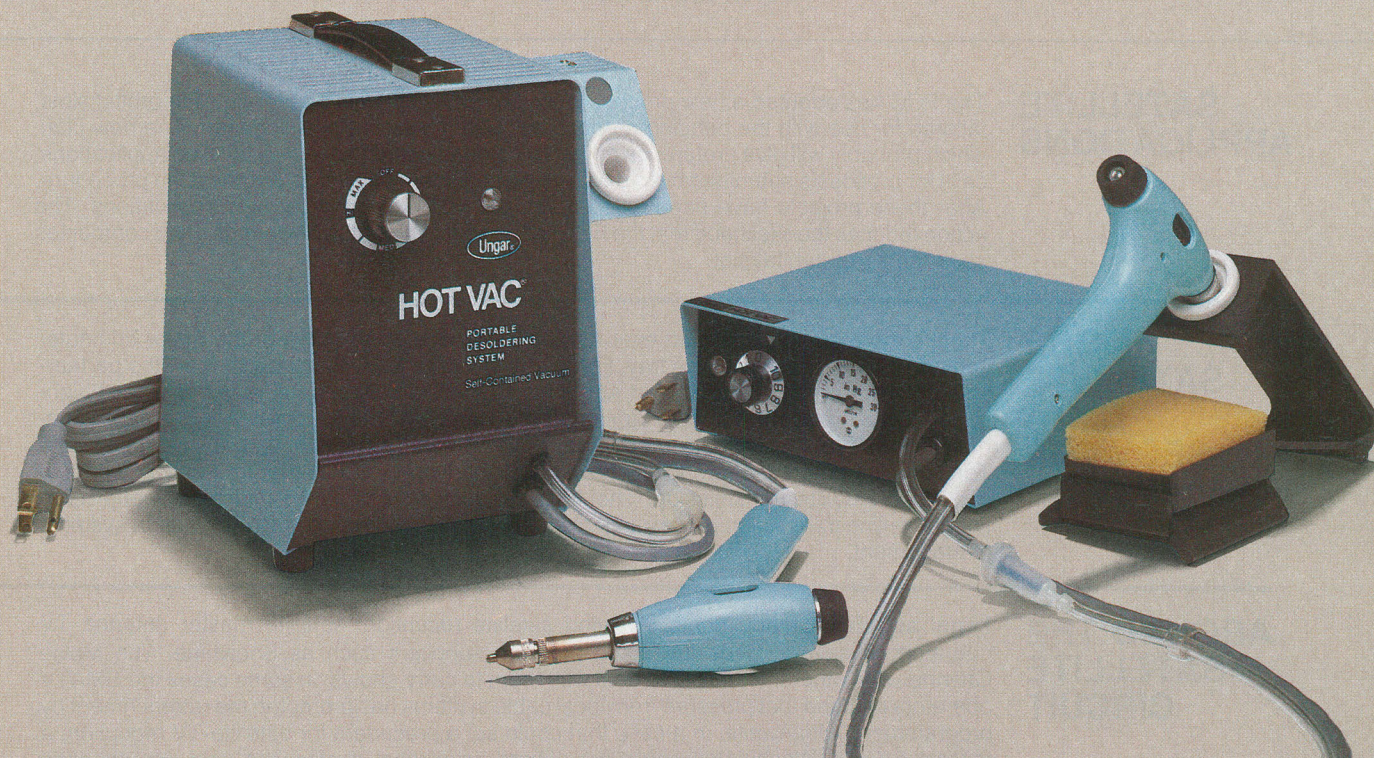
Paul McGinnis  
Paul McGinnis Company  
60 East 42nd Street  
New York, N.Y. 10017  
212-490-1021





# A Hot Tip from Ungar

**A FREE 9100 Electronic Soldering System when you buy either desoldering system by December 15, 1982.**



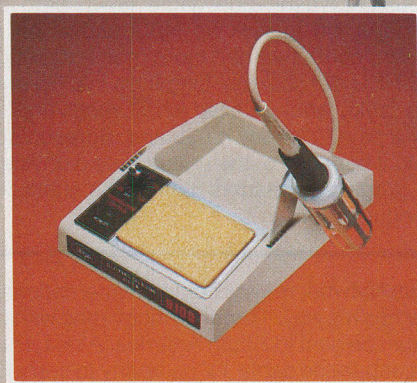
**HOT VAC® MODEL 4091  
PORTABLE DESOLDERING  
SYSTEM WITHOUT SHOP AIR.  
SUGGESTED RETAIL PRICE  
\$399.00.**

Take this ruggedly constructed, light-weight unit anywhere—plugs into any 120V outlet. Solid-state control adjusts tip temperature from 500° to 1000°F and suppresses transient spikes.

High-flow vacuum is activated by a switch mounted in a handle that's biomechanically designed to reduce fatigue and increase productivity.

Super quiet and virtually maintenance-free, with Ungar's exclusive low-noise exhaust and unique vibration-absorbing pump mounting. All built into a galvanized steel case with a scratch-resistant, baked enamel finish.

Comes complete with: Long Life Tips #2005, #2006, #2007, #2008; Tip Cleaning Tool #2002; Kleen-Tip Sponge and Tray #400; and Pack of 10 Filters #2039.



**GET A FREE MODEL 9100  
ELECTRONIC SOLDERING  
SYSTEM. SUGGESTED RETAIL  
PRICE \$91.00**

Ungar's newest electronic soldering system. Electronic, closed-loop variable control permits temperature adjustment from 400° to 800°F. Thermo-Duric® heater delivers heat to tip and away from easy-to-hold Micro-Size handle.

Includes neon "on/off" light, right- or left-hand mount and flexible, heat-resistant cord.

Comes complete with: base unit with built-in controller, handle, 1/16" screwdriver, tip #9012, sponge and tip tray, sponge and iron holder.

**HOT VAC® MODEL 2091  
WORKS ON SHOP AIR FOR  
ECONOMICAL DESOLDERING.  
SUGGESTED RETAIL PRICE  
\$365.00.**

A solid-state control adjusts tip temperature from 500° to 1000°F. The load modulated heater assures instantaneous recovery and suppression of transient spikes.

The switch that activates the high-flow vacuum is conveniently built into a handle that is biomechanically designed to reduce fatigue and increase productivity.

Comes complete with: Long Life Tips #2005, #2006, #2007, #2008; Tip Cleaning Tool #2002; Free-Standing Holder #8800 with Kleen-Tip Sponge; and Tray #400. Pack of 10 Filters, #2039.

Contact your nearest authorized Ungar dealer or call the Ungar Hotline, toll-free 1-800-421-1538, in California, call collect, 1-213-774-5950.

Offer good until December 15, 1982.



Division of Eldon Industries,  
Compton, California 90220

CIRCLE 9 ON FREE INFORMATION CARD



# SATELLITE/TELETEXT NEWS

GARY ARLEN  
CONTRIBUTING EDITOR

## SATELLITE APPLICATIONS

The FCC has adopted a new procedure for accepting applications for satellite orbital slots, tailored for use with the pending proposal to push the slots closer together. The new plan, which probably will give preference to the 10 companies that have already filed applications, calls for proposals submitted by mid-May to be considered first in any processing procedure. After those projects have been acted upon, the FCC will consider new applications. The action reduces the likelihood that the FCC will conduct competitive hearings if two companies seek the same orbital slot.

## MORE SATELLITE DATA SERVICES

There's more competition than ever for satellite space—and some of the major computer companies are now joining the fray. For example, Satellite Business Systems—the partnership of IBM, Comsat General, and Aetna insurance—is setting up a new medium- to high-speed Data Network Service, designed for customers with lower-volume data communications requirements. In a separate development, American Satellite Company and Tandem Computers Inc. are jointly developing the world's first computer network with full-integrated satellite transmission. The ASC-Tandem project, called Infosat, will offer continuous online transaction processing, distributed data processing, and information systems management.

## AROUND THE SATELLITE CIRCUIT

**Legal action** on many fronts involving satellite reception: satellite master antenna TV operators in several cities are suing program suppliers such as Showtime, The Movie Channel, and others, for failing to deal with them to carry shows; in some cases the SMATV operators contend that pressure from local cable systems has prompted the retrenchment by programmers. Meanwhile, in a case that could set a precedent for satellite-TV reception, a federal court in Washington came down hard on a local dealer who sold unauthorized receivers designed to pick up HBO shows on multipoint distribution service microwave channels. The court awarded more than \$102,000 in damages to Marquee TV Network, the local MDS-HBO service, resulting from the "illegal conduct" of a small local company which advertised, sold, and installed MDS receivers; the award was the highest amount ever granted in a pay-TV piracy case, and represented reimbursement of funds which Marquee claimed it lost because of the unauthorized devices, which could pick up its HBO signal. The court also granted permanent injunctions against several other companies that sold similar reception equipment.

## WORLDWIDE CNN

Cable News Network may become an international service, transmitted via Intelsat, if CNN's Ted Turner has his way. Turner is negotiating with Comsat for access to the Intelsat system so that CNN can be sent to South America, Africa, Europe, and Asia. CNN has already signed a deal with a Japanese cable TV company to carry CNN in Japan 17 hours per day as soon as an overseas transponder lease is completed. In return, CNN will begin picking up a daily round-up of Japanese business news, fed by satellite from Tokyo.

## "DISH STRETCHER"

Imagine a little red wagon—the kind kids play with—equipped with a four-foot satellite dish, a 12-volt battery for power, 100° LNA, and a satellite receiver. Tulsa-based Automation Techniques Inc. called this portable set-up "Toysat"—and used the micro-miniature arrangement to emphasize the potential value of its new electronic "Dish Stretcher." That unit is intended to erase "sparklies" as well as the other kinds of interference that often afflict small-dish receiver systems.

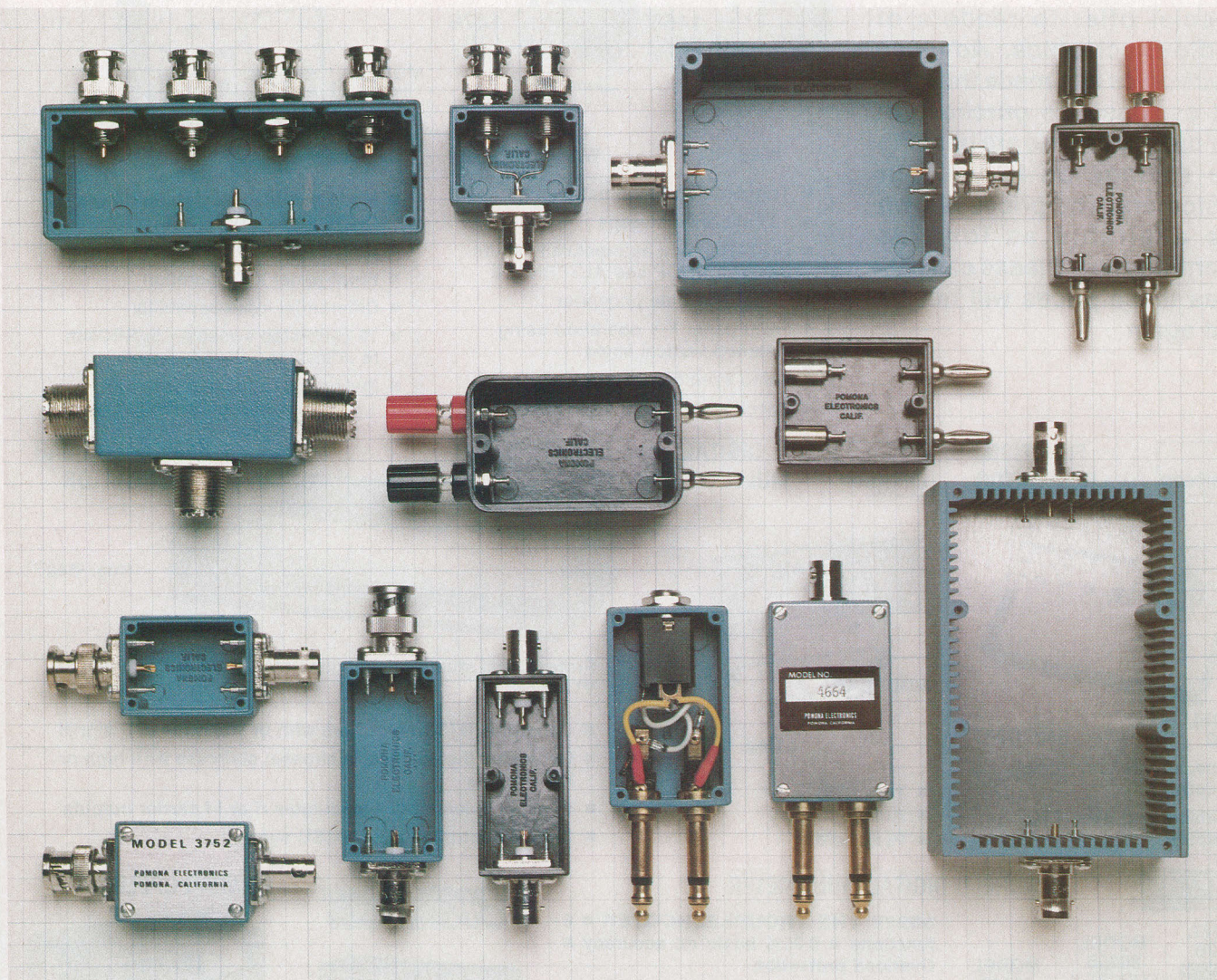
According to ATI, the level of sparklies or impulse noise in a satellite picture has been a function of either the size and efficiency of the antenna, noise figure of the LNA/receiver, or the carrier-to-noise threshold of the receiver. ATI attacked the sparklie problem in a fourth area of the receiver system: detected video signal. The sparklies generated because of the smaller dish are identified by Dish Stretcher technology as improper video information and are removed from the picture signal after entering the receiver. The \$500 unit is available from ATI, 1846 N. 106th E. Ave., Tulsa, OK 74116.

R-E



# THE POMONA PROMISE

We provide the design engineer with the best  
"black boxes" made in this country.  
Or anywhere.



That may seem like a tough promise to deliver on. But if you talk to the professionals of the electronics industry, you'll learn quickly and with great assurance that the "black boxes" designed and produced by ITT Pomona Electronics are looked upon as the best in the business. Bar none.

The reason goes back to when we first introduced the idea of providing convenient containers for special test circuits. We promised then that ours would be the best. And that's the way it's been.

Since then our line has ex-

panded to eleven different series to accommodate just about any component packaging requirement you'll ever need.

At ITT Pomona Electronics, we know there is no such thing as standing pat. We also know that your needs change and your expectations become greater as the demands become more severe. To this end we will continue to create a better way. A better product.

That's a promise.

All of our products are described and illustrated in our General Catalog, and it's free. Just call (714) 623-3463 or 623-6751.

TWX 910-581-3822. Write to us at ITT Pomona Electronics, a Division of International Telephone and Telegraph Corporation, 1500 E. Ninth St., Pomona, CA 91766.

In Europe: ITT CANNON BELGIUM S.A./N.V. Rue Colonel Bourg Str. 105 Space A (B.3) 1140 Brussels, Belgium. Phone: 02-735-6094.

Our products are available through your favorite electronics parts distributor.

**ITT** Pomona Electronics

CIRCLE 8 ON FREE INFORMATION CARD





**PHILIPS**



**TRIPLETT**

**KEITHLEY**

**LEADER**



**Non-Linear Systems**

Special offer to readers of Radio-Electronics. *Advance Electronics* has made the largest oscilloscope purchase in our history and we are passing the savings on to you our customers. The prices shown are available as long as quantities last. Please call early as these prices will not be had again.

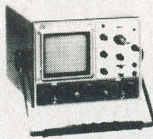
**BK PRECISION**

**5" SCOPES**



1466  
SINGLE  
TRACE

**\$329<sup>95</sup>**  
WAS \$480<sup>00</sup>



1476  
DUAL  
TRACE

**\$395<sup>00</sup>**  
WAS \$570<sup>00</sup>

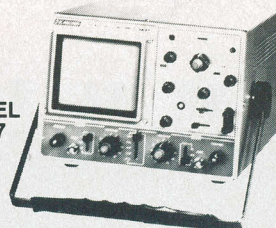
PRICE DOES NOT INCLUDE PROBES

- Triggered and automatic sweep
- 18 calibrated sweeps
- On 1476 mode automatically shifts between CHOP and ALTERNATE
- Bright P31 blue phosphor
- Front panel X-Y operation using matched vertical amps
- Video sync separators
- Check most digital logic circuitry

**BK PRECISION**

**15 MHz TRIGGERED  
SWEEP SCOPE**

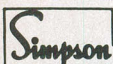
MODEL  
1477



**\$495<sup>00</sup>**  
WAS \$645<sup>00</sup>

PRICE DOES NOT INCLUDE PROBES

- Mode automatically shifts between CHOP and ALTERNATE
- Bright P31 blue phosphor
- Front-panel X-Y operation
- Differential input capability
- 19 calibrated sweeps—.5 $\mu$ SEC/cm to .5SEC/cm
- Sweep to .1 $\mu$ SEC/cm with 5x; 1.5SEC/cm with uncalibrated vernier



**FUNCTION  
GENERATOR**



MODEL  
420

**\$169<sup>95</sup>**  
Reg. \$194<sup>00</sup>

- Sine, square and triangle output
- Variable and fixed TTL outputs



**DIGITAL  
MULTIMETER**



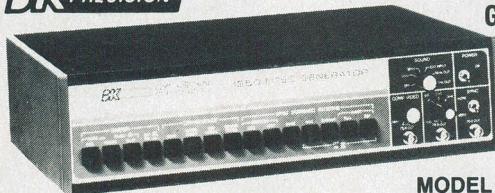
MODEL 467

**\$229<sup>95</sup>**  
Reg. \$259<sup>00</sup>

- True RMS
- Analog display
- Peak hold

**BK PRECISION**

**NTSC COLOR-BAR  
GENERATOR**



MODEL 1250

**\$699<sup>95</sup>**  
Reg. \$849<sup>00</sup>

Professional studio quality generator. Ultra stable. Ideal for VTR work.

- Generates NTSC color bars with or without—IWQ signal
- Generates 5 step linear staircase; staircase with high or low chroma
- External video input—modulates rf or i-f carrier outputs
- Crystal controlled rf, i-f, NTSC sync



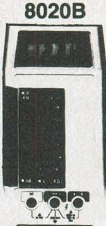
**HANDHELD DIGITAL MULTIMETER**

MODEL  
8022B



**\$144.**

MODEL  
8020B



**\$194.**

MODEL  
8024B



**\$249.**

**8022B THE TROUBLESHOOTER** ■ 6 functions ■ 0.25% basic dc accuracy ■ Overload protection

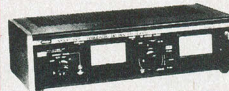
**8020B THE ANALYST** ■ 7 functions ■ 0.1% basic dc accuracy ■ LCD display ■ Safety design test leads.

**8024B THE INVESTIGATOR** ■ 9 functions ■ 0.1% basic dc accuracy ■ Peak hold on voltage and current functions ■ Selectable audible indicator for continuity or level detection.

**FREE CASE FOR EACH FLUKE HANDHELD DMM**

**BK PRECISION**

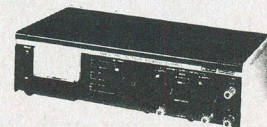
**POWER SUPPLIES**



MODEL  
1601

**\$279<sup>95</sup>**  
was \$354.

- Isolated 0-50VDC, continuously variable; 0-2A in four ranges
- Fully automatic shutdown, adjustable current limit
- Perfect for solid state servicing



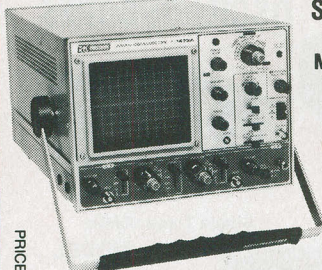
MODEL  
1650

**\$299<sup>95</sup>**  
was \$375

- Functions as three separate supplies
- Exclusive tracking circuit
- Fixed output 5VDC, 5A
- Two 0 to 25VDC outputs at 0.5A
- Fully automatic, current-limited overload protection

**WE AT ADVANCE ELECTRONICS WISH YOU A  
HAPPY AND HEALTHY HOLIDAY SEASON!**



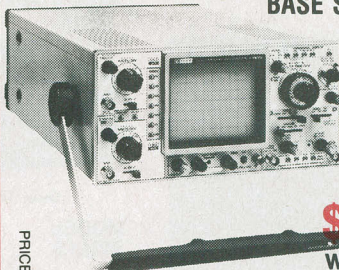
**BK PRECISION****HITACHI****FLUKE****VIZ** formerly **ROA****HICKOK****DATA PRECISION****DORIC****BK PRECISION****30 MHz TRIGGERED SCOPE**

MODEL 1479B

**\$595<sup>00</sup>**  
was \$895.

- Built-in signal delay line permits view of leading edge of high frequency pulse rise time.
- Triggers on signals up to 50MHz
- Rectangular CRT with P31 phosphor
- Mode automatically shifts between CHOP and ALTERNATE

PRICE DOES NOT INCLUDE PROBES

**BK PRECISION****70 MHz. Dual Time BASE SCOPE**

MODEL 1570

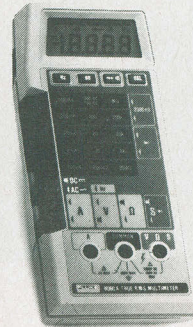
**\$995<sup>00</sup>**  
WAS \$1570

- 1 mV/division sensitivity to 70 MHz
- 500  $\mu$ V/division cascade sensitivity
- Four-input operation provides trigger view on 4 separate inputs.
- Alternate time base operation
- Switching power supply delivers best efficiency and regulation at lowest weight

PRICE DOES NOT INCLUDE PROBES

**FLUKE****4 1/2 DIGIT MULTIMETERS**

MODEL 8060A

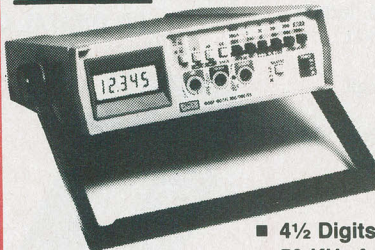


- Frequency measurements to 200KHz
- dB measurements
- Relative measurements
- True RMS
- High-speed Beeper

**\$349<sup>00</sup>****BK PRECISION****INDUSTRIAL TRANSISTOR TESTER****\$189<sup>95</sup>**  
was \$239

MODEL 520B

- Now with HI/LO Drive
- Works in-circuit when others won't
- Identifies all three transistor leads
- Random lead connection
- Audibly and visually indicates GOOD transistor

**FLUKE****DIGITAL MULTIMETER**

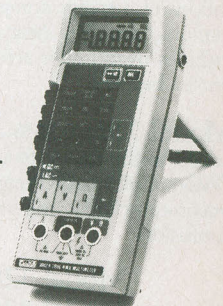
MODEL 8050A

**\$389<sup>00</sup>**

- 4 1/2 Digits
- 50 KHz frequency response
- 10  $\mu$ V resolution
- .03% accuracy
- True RMS ■ dB
- measurements and memory relative

8050A-01  
RECHARGEABLE  
\$439<sup>00</sup>

MODEL 8062A



- .05% accuracy
- True RMS
- 30KHz bandwidth
- Relative measurements
- Beeper

**\$279<sup>00</sup>****FREE CASE** FOR EACH FLUKE HANDHELD METER**BK PRECISION****FUNCTION GENERATORS**

MODEL 3010

- Sine, square and triangle output
- Variable and fixed TTL outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 1 Hz to 100kHz

MODEL 3010 **\$179<sup>95</sup>**  
was \$220.MODEL 3020 **\$299<sup>95</sup>**  
was \$379.**SWEEP FUNCTION MODEL 3020**

- Four instruments in one package—sweep generator, function generator, pulse generator, tone-burst generator
- Covers 0.02Hz-2MHz
- 1000:1 tuning range
- Low-distortion high-accuracy outputs

**BK PRECISION****CAPACITANCE METERS**

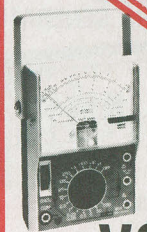
MODEL 830

- Automatically measures capacitance from 0.1pF to 200mF
- 0.1pF resolution
- 0.2% basic accuracy
- 3 1/2 digit LCD display

**\$179<sup>95</sup>**  
was \$229.**\$149<sup>95</sup>**  
was \$185.

MODEL 820

- Resolves to 0.1pF
- 4 digit easy-to-read LED display
- Fuse protected against charged capacitors
- Overrange indication

**VOM**  
20,000  $\Omega/V$ 

with the purchase of \$500. or more.

**TOLL FREE HOT LINE**  
**800-223-0474**

54 WEST 45th STREET, NEW YORK, N.Y. 10036 212-687-2224

**THE TEST EQUIPMENT SPECIALISTS****ADVANCE ELECTRONICS**





**PHILIPS**



**TRIPLETT**



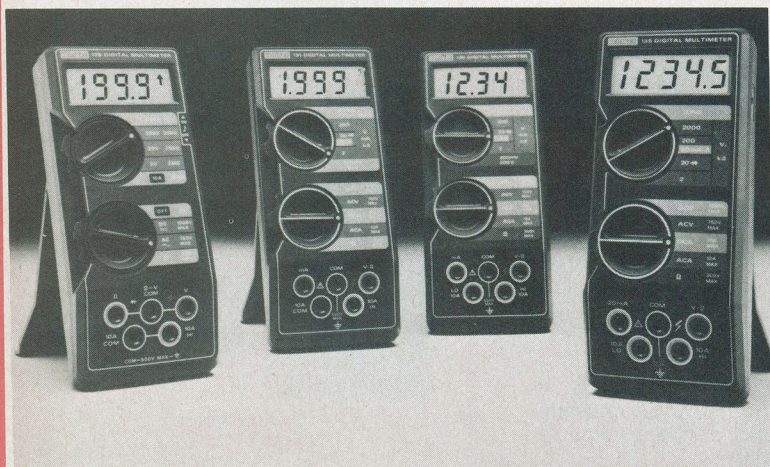
**Non-Linear Systems**

**KEITHLEY**

**LEADER**

**KEITHLEY**

**DIGITAL MULTIMETERS**



**Model 128:** Beeper DMM designed to meet the tough specifications of a major computer manufacturer. See/hear display includes over/under arrow and on/off beeper.

**Model 131:** 0.25% accuracy added to the easiest to use handheld DMM. Color-coded front panels for maximum clarity, minimum confusion.

**Model 130:** Keithley user research led to unique DMM designs. Easy to read LCDs, largest DMM displays on the market.

**Model 135:** First 4½-digit handheld DMM, ideal for analytical/bio-medical service. 10A range standard on all Keithley handhelds.

Model 128: **\$139.00**  
Model 130: **\$124.00**

Model 131: **\$139.00**  
Model 135: **\$235.00**

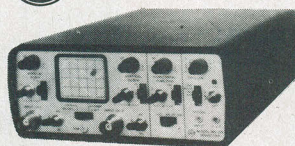
**FREE CASE**

FOR EACH **KEITHLEY** HANDHELD METER



**Non-Linear Systems**

**PORTABLE OSCILLOSCOPES**



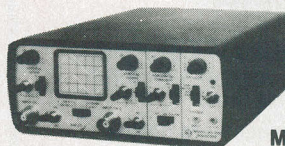
Dual Trace 15 MHz

**MODEL MS215**



Single Trace 15MHz

**MODEL MS15**



Dual Trace 30MHz

**MODEL MS230**

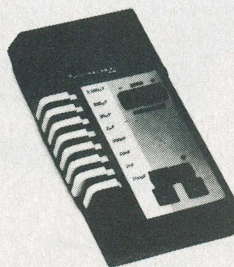
**Call for our prices**

PRICE DOES NOT INCLUDE PROBES



**DATA PRECISION**

**LCD DIGITAL CAPACITANCE METER, 0.1%, 3½ DIGIT**

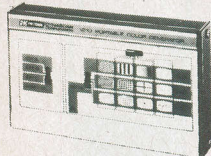


**MODEL 938**

**\$219<sup>00</sup>**

- **WIDE RANGING** — from 199.9 pF full scale (0.1 pF resolution) up to 1999 µF full scale, in eight ranges...virtually every capacitance you'll ever need to measure.
- **FAST AND EASY TO USE** — Direct reading, push-button ranges. Just plug in and read.
- **EXCEPTIONALLY ACCURATE** — provides ±0.1% basic accuracy.
- **PORTABLE** — Palm-sized, light-weight, operates up to approximately 200 hours on a single 9V alkaline battery.
- **EASY READING** — big, clear, high-contrast 3½-digit LCD display, a full 0.5" high, readable anywhere.
- **VALUE PACKED** — Outstanding measurement capability and dependability. Outperforms DC time-constant meters, and even bridges costing 2 to 5 times as much.

**BK PRECISION COLOR PATTERN GENERATOR**



**MODEL 1210 \$129<sup>95</sup> was \$159**

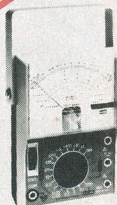
- Generates 10 stable patterns including crosshatch, 7×11 dot, gated rainbow and purity.
- Compact for convenient field service use

**VIZ**



**WE STOCK FULL LINE OF VIZ ANALOG and DIGITAL POWER SUPPLIES**

**FREE**

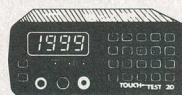


**VOM**

20,000 Ω/V with the purchase of \$500. or more.



**DIGITAL MULTIMETERS**



**MODEL TT 20B**

**\$399<sup>95</sup>**

Reg. \$537<sup>00</sup>

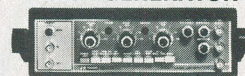
**MODEL TT 21B**

**\$469<sup>95</sup>**

Reg. \$595<sup>00</sup>

**BK PRECISION**

**PULSE GENERATOR**



**\$299<sup>95</sup> MODEL 3300**

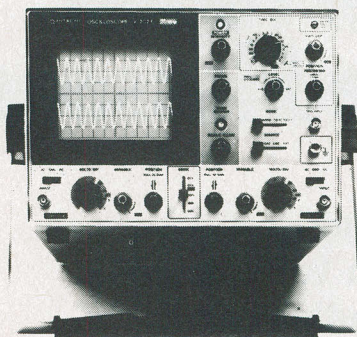
was \$375.

- Pulse period range of 200 nano-seconds to 1 second; frequency range of 5MHz to 1Hz
- Rise time is less than 15ns for 50-ohm high-speed output

We carry a full line of multimeters, oscilloscopes, frequency counters, audio and RF generators, power supplies and accessories.

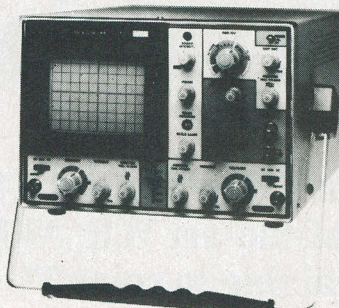
Just call our Toll-Free number and one of our experts will answer all your questions about test equipment.



**BK PRECISION****HITACHI****FLUKE****VIZ** formerly **R&A****HICKOK****DATA PRECISION****DORIC****HITACHI** 20MHz  
DUAL TRACE

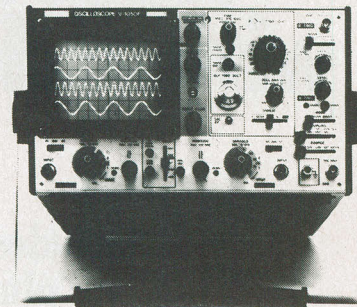
**MODEL 202**  
INDUSTRIAL FLAT  
FACE RECTANGU-  
LAR CRT **\$499<sup>95</sup>**

PRICE DOES NOT INCLUDE PROBES

**HITACHI** 35MHz  
DUAL TRACE  
W/DELAY

**MODEL 352**  
HIGH PERFOR-  
MANCE LAB SCOPE.  
A MINUS B INPUT **\$699<sup>95</sup>**

PRICE DOES NOT INCLUDE PROBES

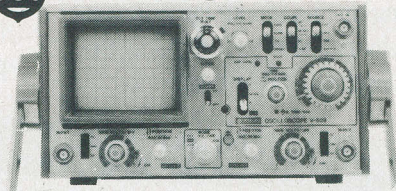
**HITACHI** 100MHz  
DUAL TRACE  
DUAL TIME BASE

**MODEL 1050**  
QUAD TRACE ABIL-  
ITY. A INTENSIFIED **\$1499<sup>95</sup>**  
BY B

PRICE DOES NOT INCLUDE PROBES

**BECKMAN**  
DIGITAL MULTIMETERS

**300 310 320**  
**330 350 360**  
ALL IN STOCK  
CALL FOR PRICES

**HITACHI** OSCILLOSCOPES

**NEW —  
NOW  
AVAILABLE**

V209 20 MHz, Dual Trace, Portable,  
Complete with built-in Battery Pack.  
V509 50 MHz, Dual Trace, Dual  
Time Base, Portable (Battery pack  
optional).

**\$749<sup>95</sup>**  
**\$1395<sup>00</sup>**

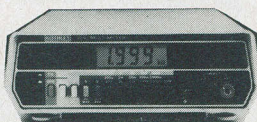
PRICE DOES NOT INCLUDE PROBES

**WESTON****\$149<sup>00</sup>**BEEP  
BEEP

- Six Functions
- 29 Ranges
- 0.5% Accuracy on DCV
- 5 Range Audio Response Function
- Color coded easy-to-read front panel and pushbuttons
- 0.5" LCD Display
- Rugged Case for "Field Use"
- RFI Shielded

**BK PRECISION**  
PORTABLE  
TRANSISTOR TESTER**\$109<sup>95</sup>** was \$135.

- Fast GO/NO-GO in-circuit transistor testing
- Fast and thorough GOOD/BAD out-of-circuit testing

**KEITHLEY**  
BENCH/PORTABLE**MODEL 169** 3½ DIGIT **\$189<sup>00</sup>****MODEL 176** 4½ DIGIT **\$269<sup>00</sup>****BELL'S**  
CURRENT  
GUN**\$179<sup>95</sup>**Reg. \$199<sup>00</sup>

MEASURES AC or DC  
CURRENT 1MA - 100  
AMPS WITHOUT  
BREAKING THE CIR-  
CUIT. WORKS IN CON-  
JUNCTION W/ANY VOM  
OR OSCILLOSCOPE

**ORDERING  
INFORMATION**

We don't just take  
orders we ship orders  
*Advance Electronics*  
endeavors to keep everything  
we advertise in stock for  
immediate delivery.

- Mastercharge & Visa shipped within 24 hours.
  - Bank checks or Money Orders shipped within 24 hours.
  - Personal checks — please allow 3 weeks for check to clear.
  - All prices plus shipping charges. Please call for appropriate charges. Use our toll free number.
  - New York State residents add appropriate sales tax.
  - PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
- Quantities are limited Offer ends Jan 31, 1983



TOLL FREE HOT LINE  
**800-223-0474**

54 WEST 45th STREET, NEW YORK, N.Y. 10036 212-687-2224

**THE TEST EQUIPMENT SPECIALISTS****ADVANCE  
ELECTRONICS**



# **New from NRI!** **The first at-home training in** **videocassette recorder repair** **with exclusive videotaped lessons.**

**Learn TV/Audio/Video Servicing...**  
**includes state-of-the-art VCR, NRI Action Video lessons,**  
**plus full training in color TV and audio repair.**

Now, you can learn the hottest,  
most wanted skill in home entertainment  
electronics...servicing and repairing

videocassette recorders and video disc  
players. Well over 2 million units have  
already been sold and the demand is just  
starting! Already, qualified VCR techni-  
cians are in short supply...people are  
waiting up to a month for VCR repair.  
Good jobs at good pay are going beg-  
ging. And NRI can get you in on the

action with convenient and effective  
at-home training.

## **Choice of Specialized Training**

NRI offers you three Master Courses  
in TV/Audio/Video Servicing, each com-  
plete, each with equipment and training







Specialized training on Heath/Zenith Model 2501 25" (diagonal) color TV, videocassette recorder, or AM/FM stereo you keep for yourself.

for the specialty you want. Each course thoroughly prepares you for color TV plus audio and video equipment. Then, you take the specialized hands-on training on the equipment you select.

You can get specialized audio experience as you build your own AM/FM stereo system complete with speakers. Or gain real bench experience with hands-on TV training as you build a 25" (diagonal) fully computerized, programmable color TV and professional test instruments. Or train with your own RCA videocassette recorder and NRI's exclusive Action Video servicing lessons on videotape.



## State-of-the-Art VCR

This modern VCR features high-technology design with electronic pushbutton tuning, remote control, three recording speeds with up to 6-hour capacity, high-speed visual search, built-in clock/timer, memory rewind and audio dubbing capability. Direct drive motors and azimuth recording give outstanding picture reproduction.

It's yours to keep, as part of your training. You'll not only use it to learn operation and servicing techniques, but to play the absorbing NRI Action Video lessons that come as part of your specialized training. In word and picture, you'll learn theory, construction, and service procedures, see them explained in graphic closeups. And you get this unique training only with NRI!

## Learn at Home at Your Convenience

No need to quit your job or tie up your evenings at night school. No time away from your family or expensive travel. NRI comes to you. You are a class of one, getting both theory and practical hands-on training backed up by our staff of experienced educators.

## NRI the Pros' Choice

More than 67 years and a million and a half students later, NRI is still the first choice in home-study schools. A national survey of successful TV repairmen shows that more than half have had home-study training, and among them, it's NRI 3 to 1 over any other school.

That's because you can't beat the training and you can't beat the value. Only NRI combines exclusive fast-track training techniques with modern state-of-the-art equipment to give you the skills you need for success quickly and easily. Only NRI offers such complete training

with so many timely options for specialized bench experience. Send for our free catalog and get all the facts on these exciting Master Courses in TV/Audio/Video servicing.

## Free Catalog... No Salesman Will Call

Mail the coupon today for your free copy of our 100-page look into tomorrow. It shows all the equipment you get, describes each lesson in detail. And it tells you about other important career opportunities in Microcomputers and Microprocessors, Digital and Communications Electronics, Electronic Design



Other NRI courses include microcomputers, communications electronics, electronic design, industrial electronics.

Technology, and more. Send today and get started on a big new future for yourself. If card has been removed, please write to us.



**NRI SCHOOLS**  
McGraw-Hill Continuing  
Education Center  
3939 Wisconsin Ave.,  
Washington, D.C. 20016

**We'll give you tomorrow.**



# LETTERS

Address your comments to: Letters, **Radio-Electronics**,  
200 Park Avenue South, New York, NY 10003

## ROAD-INFORMATION SYSTEMS

I wish to respond to a letter in the July 1982 **Radio-Electronics** by Mr. Charles E. Koontz regarding road-information systems. First thing, I feel that such systems are really not needed in most areas of the United States. Just listen to any local radio station during the morning or afternoon drive-times, and you will hear plenty of traffic information. I think that the functions of roadside-information stations and auxiliary services that Mr. Koontz is discussing are already fulfilled by most radio stations. I also think that the FM system discussed in his letter is not as practical as the proposals for roadside stations that would have been located at the low end of the standard AM broadcast-band. Those AM stations could give better coverage and at lower transmitter power for the same area served. Also low-power and auxiliary services broad-

cast in FM would only be more difficult to receive in a moving automobile. I also wonder whether the public and the radio stations are interested at all in a system to transmit pictures over the existing FM band. That *sounds* interesting—but what real purpose could it serve?

Mr. Koontz must understand that the main-channel carrier space of a modern FM broadcaster is very valuable material. To the broadcaster, it is far more profitable to sell advertising time than to rent space on his carrier for SCA or other auxiliary services, possibly downgrading his signal. Mr. Koontz should remember that the broadcaster must give up about 10% modulation percentage for each auxiliary service. In most cases, that is not permissible. Note that most stations that carry SCA or other auxiliary services are non-commercial. The FM broadcast industry is more competitive now than it was 25 years

ago. Modern broadcast-equipment designers are really more concerned in allowing the broadcaster to get the most out of his main channel.

Now to a discussion on modern FM-broadcast technology: Mr. Koontz points out "reduced coverage" from Class-B and Class-C FM-radio stations; that is far from the real truth. Modern FM broadcasting antennas, built from the late 1960's to date, use a circularly polarized radiation pattern—that is, the antenna radiates in *both* the horizontal and vertical planes. Older antennas radiated only a horizontally polarized signal. Such horizontally polarized antennas are totally useless to the modern broadcaster. A majority of the FM receivers now used by the public use *vertically* polarized antennas. That includes portable radios and automobile receivers. A modern broadcaster is most concerned with "penetration"—the number of receivers that

## THE performers.

Model 7000



\$330

### NEW

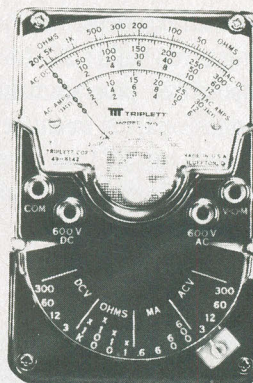
1. High resolution,  $\mu$ P controlled reciprocal counting design provides both input signal frequency and period measurements.
2. 80 MHz frequency measurement plus event counting to 1 billion and elapsed time measurement from 100  $\mu$ S to 100 hours.
3. Single function knob for easier operation and built-in self-testing confidence test circuit.

Model 7000 TCXO version \$440

Contact your local Triplet Distributor or Factory.  
Phone 419-358-5015, TWX 810-490-2400.

**Triplet performance . . .  
a tough act to follow**

## THE performers.



Model 310

\$70.00

1. Drop-resistant, hand-size V-O-M with high-impact thermoplastic case.
2. 20,000 Ohms per volt DC and 5,000 Ohms per volt AC; diode overload protection with fused Rx1 Ohms range.
3. Single range switch; direct reading AC Amp range to facilitate clamp-on AC Ammeter usage.

Contact your local Triplet Distributor or Factory.  
Phone 419-358-5015, TWX 810-490-2400.

**Triplet performance . . .  
a tough act to follow**



It's like having X-ray ears...

## Tiny, powerful electronic "ears" let you hear whispers through walls, conversations 2 miles away.

### The Dyna-Mike Transmitter

It's smaller than a quarter. But DYNA-MIKE will transmit every sound in a room to an FM radio tuned to the proper unused frequency, from 1/3 mile to 2 miles away.

If you're at a neighbor's home a block from your own, you can hear your baby's cry, or you can tell the instant your spouse comes home. If two of you are driving tandem in two cars, one or both of you can communicate with the other even if other cars drive between you.

DYNA-MIKE has as many uses as your imagination can think of. For a business conference, let the tiny microphone sit unobtrusively on the table or concealed on a shelf, and you'll be able to record every word. For businesses, you can put an FM receiver in a warehouse or remote office and "broadcast" instructions or orders to be filled.

Public speakers never had a better friend than the DYNA-MIKE. No wires or setup — just turn on one or more radios and your speech will come through with perfect fidelity. Put one on the front porch. If you hear a suspicious sound, turn on the radio and you'll hear the doorbell or the ring of the telephone.

#### Choose Your Model

New Horizons is introducing three models of the DYNA-MIKE supersensitive broadcast microphone. Model IC-18 is the world's smallest microphone — it's a miracle of electronic miniature power, with a high-fidelity range of 1800 feet. Introductory price is \$129.95 (two for only \$119.95 each).

Model X-18 is the longest-range microphone, with an unbelievable two-mile range. Introductory price is \$149.95 (two for only \$139.95 each).

Model X-3 is the most sensitive microphone. It broadcasts perfect-quality sound even from low-levels or whispers, up to 1,500 feet. Introductory price is \$99.95 (two for only \$89.95 each).

Each microphone is fully wired, complete with standard HC-1.35v. battery, good for 100 hours of continuous use and easily and inexpensively replaceable.

Of course you're protected by the New Horizon guarantee: use any DYNA-MIKE transmitter microphone for 30 days, with the right to return it for a full refund if you're not delighted.

— Phone or use this coupon —

### The Super-Ear

You'll hear it all.

Effortlessly, you can hear not just a baby's cries, but quiet breathing, through a concrete wall a foot thick. Put the SUPER-EAR earphone in your ear and place the speaker on the wall. That's all there is to it.

SUPER-EAR hears everything, and even more astounding, hears it clearly. It's as though the wall weren't there. If you're coming home late at night and think intruders are in your residence, let SUPER-EAR find out for you. Want to know if the meeting is over in the room with the closed door? SUPER-EAR will tell you in a second.

SUPER-EAR is undetectable from the other side of the wall. The quality of sound has amazing fidelity—good enough to record, and SUPER-EAR has its own built-in recorder jack.

Because SUPER-EAR is the ultimate listening device, you can use it to pinpoint hidden squeaks in your car or the source of mysterious engine noises.

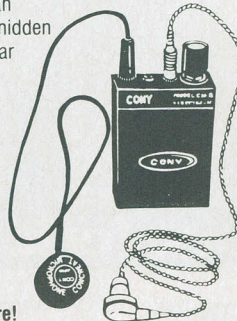
Construction experts use it to check for flaws or cracks in buildings.

#### It Works Anywhere!

Ever put your ear to a railroad track to try to hear the train? Try it with SUPER-EAR. You'll hear that train many miles away. Use it as a powerful stethoscope on yourself, a friend, or a pet. You can even hear a bird's breathing.

The only source for SUPER-EAR is New Horizons. Choose from two models — Model SB-5, with ultrasensitive microphone, \$139.95 (two for only \$129.95 each); or Model SB-1, with suction-type microphone, \$99.95 (two for only \$89.95 each).

Use your SUPER-EAR for 30 days. If for any reason you're not delighted, the absolute New Horizons guarantee means you can return it for a prompt refund.



### The Phone Answerer Recorder

The PHONE ANSWERER/RECORDER connects in seconds between any tape recorder and your telephone. When you're away it automatically delivers a message up to 20 seconds to anyone who calls: when you'll return, when to call back, where you are.

When you're there, the ANSWERER/RECORDER starts any cassette recorder automatically when you pick up the phone and shuts off when you hang up.



It records both sides of the conversation with astonishing clarity, giving you a permanent record of every call, preventing unauthorized use of your phone, and eliminating misunderstandings over what was said. It's specially wired to extend recording time on your tape recorder. Needs no batteries — it's always "alive".

The PHONE ANSWERER/RECORDER is a masterpiece of miniaturization. It's yours for \$49.95 (two for only \$44.95 each). PHONE RECORDER unit alone, records but doesn't answer, \$29.95 (two for \$24.95 each). Every instrument has the unbeatable New Horizons guarantee.

For immediate service on credit card orders, call toll-free 24 hours a day, seven days a week:

**1-800-227-1617**  
**Ask for operator NO. 110**  
in California: 800-772-3545

We Absolutely Guarantee! Use any electronic instrument acquired from us for up to 30 days. If you decide for any reason that you don't want to keep it, return it for a 100% refund.

## NEW HORIZONS

245 Fifth Ave.  
Suite 1516  
New York, N.Y. 10016

New Horizons, 245 Fifth Ave., Suite 1516 PE, New York, N.Y., 10016

Please ship at once, with 30-day money-back guarantee:

— Phone or use this coupon —

- ☐ Super-Ear Model SB-5, \$139.95
- ☐ 2 for \$129.95 each
- ☐ Super-Ear Model SB-1, \$99.95
- ☐ 2 for \$89.95 each
- ☐ Dyna-Mike Model IC 18, \$129.95
- ☐ 2 for \$119.95 each
- ☐ Dyna-Mike Model X-18, \$149.95
- ☐ 2 for \$139.95 each
- ☐ Dyna-Mike Model X-3, \$99.95
- ☐ 2 for \$89.95 each
- ☐ Phone Answerer/Recorder, \$49.95
- ☐ Phone Recorder, \$29.95
- ☐ 2 for \$24.95 each

Indicate payment method:

☐ Check enclosed  
☐ Bill to ☐ VISA ☐ Master Card

No. \_\_\_\_\_

Expires \_\_\_\_\_ Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Please add \$1.75 per total order for shipping.

CIRCLE 92 ON FREE INFORMATION CARD



his signal can reach in the station's service area. It is true that horizontal-polarized antennas could give the station better range, but that would be useless to people who have vertically polarized antennas on their receivers.

As far as transmitters and exciters are concerned, any station still using a 25-year-old exciter and transmitter would not survive. You could get by with using a 25-year-old transmitter in AM radio and TV, but not FM broadcast. In fact, most of those old FM transmitters were relegated to auxiliary service, or even scrapped, when FM stereo came about. This is why: Old transmitters used modulator and multiplier stages that had insufficient bandwidth to handle the stereo-modulating signal. Also, the multiplier stages distorted the stereo information. A modern,

solid-state FM exciter is actually a marvelous instrument compared to the primitive exciters. Its solid-state modulator and AFC circuits require little or no adjustments, and are capable of far lower distortion and greater bandwidth. There are only a few or no multiplier stages that don't require tuning. The new exciters are compact and efficient, and not susceptible to microphonics.

The modern transmitter is a far superior performer compared to the older models. The newer and more efficient stages give wider bandwidth, easier tuning, and are much more efficient. They are less likely to cause distortion and harmonics. The modern transmitter is very "transparent" to the exciter's signal. As far as interference is concerned, such problems are very rare, because both transmitters and exciters are well shielded.

Here are some other considerations that broadcasters use in evaluating transmitters: They want something that is very energy-efficient, because the transmitter uses more electricity than any other device that the station uses. Older transmitters are just too inefficient, and every kilowatt the transmitter uses means bigger bucks each year on the power bill. That is getting very important. Also, parts and tubes for 25-year-old transmitters are getting very expensive, and difficult—if not impossible—to obtain, because so many of the manufacturers have long gone out of business. Even parts for equipment 10-15 years old have become hard to obtain. Also, old transmitters were not available in the power levels that broadcasters require now. The use of lower-gain, wide-beamwidth antennas requires a higher-power transmitter.

To sum it up: If Mr. Koontz would listen carefully to an FM radio station using new equipment, he would be surprised at how well it can perform: far better than 25-year-old or even 10-year-old technology. It's just like trying to say that a 20-year-old black-and-white tube-type TV set is better than a solid-state 1982 color receiver.

I can agree with Mr. Koontz on FM tuners. If someone asks me about them, I will reply that spending more than \$500 on a tuner is a waste of money. I laugh at people who spend \$1000 on a tuner and brag about the reception. These days, hi-fi FM listeners are in a minority; modern radio stations try to cater to those listeners who have portable radios. What sounds good on a portable may sound loud, dense, and harsh over your stereo. Whether you like it or not, that's the way it is—I don't agree with it, either.

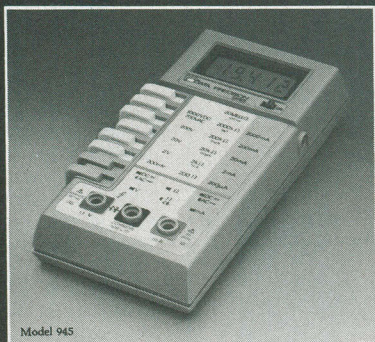
To tell Mr. Koontz more: The transmitter is actually a minor cause of signal degradation for his station. The most probable cause is the telephone lines that the station may be using to relay program material to a remotely located transmitter. Those telephone lines can have unstable frequency response and distortion. Also, transients, intermodulation, and phase distortion over those lines are a problem. I don't want to downgrade the telephone companies that provide those lines. Most of them try to be cooperative and are sympathetic to the stations' needs; they do try very hard to provide adequate service under tough conditions.

If the station is lucky enough to be using a microwave STL system, the improvement in sound quality can be very startling. Another problem that stations have is distortion in phono and tape systems—those can have more distortion than a typical new transmitter. The problems are the same as those you have with phono and tape machines in your stereo at home.

I can also agree with Mr. Koontz about the Grundig FM receivers: They were high quality for their time. True, the older ones aren't stereo, but they could give excellent results. I have a Grundig radio-phono console that has an AM/FM shortwave tuner that suffered the same fate as some of Mr. Koontz's receivers: bad switches, old capacitors, and old age. The person who gave it to me said that he purchased it in 1959. I am now unable to repair it because the switches are unavailable, along with some of the tubes.

I apologize for the length of this letter, but I had to go to lengths to explain what is going on these days in modern radio stations. I

## 4½ DIGIT PORTABLE RESOLUTION.



**We make a case for it.**

There are times when a 3½-digit multimeter just can't cut it. When you really need resolving power, you need a 4½-DMM. For example, if you're measuring a 15VDC supply, you can see every millivolt of change on a 4½-digit instrument. But a 3½ won't show a change of less than 10 millivolts.

The Model 945 packages the resolution of a full-function 4½ into a convenient calculator-style case. With simple one-hand operation, 100

**In fact, we make two cases!**



Model 255

hours disposable battery life, and the high-contrast LCD readout, the 945 is an unbeatable instrument for the field.

The Model 255 does double duty. It is a portable instrument, operating 100 hours in the field on rechargeable

NiCad batteries. Plus its AC line operation, additional accuracy and front-panel configuration give you the added performance of a laboratory/bench instrument.

For immediate delivery, demonstration, or instrumentation catalog, just contact your local Data Precision distributor or call:

**(800) 343-8150  
(800) 892-0528 in Massachusetts.**

**Maintaining the Integrity of Measurement.**

**The leader in 4½ digit multimeters.**

Model	Accuracy	DCV	ACV	Current	Ohms	Frequency Response	AC-DC Converter Type	Price (USA)
945	±.05%	10μV-1000V	10μV-700V	10nA-2A	10mΩ-20MΩ	Average Sensing	1kHz	\$265
255	±.03%	10μV-1000V	10μV-500V	10nA-2A	100mΩ-20MΩ	Average Sensing	1kHz	\$295
245	±.05%	100μV-1000V	100μV-500V	1μA-2A	100mΩ-20MΩ	Average Sensing	50kHz	\$385
248	±.05%	10μV-1000V	10μV-500V	10nA-2A	100mΩ-20MΩ	RMS Sensing	20kHz	\$385
258	±.05%	10μV-1000V	10μV-500V	10nA-2A	100mΩ-20MΩ	RMS Sensing	20kHz	\$355

**DATA PRECISION**  
DIVISION OF ANALOGIC CORPORATION

Data Precision Division of Analogic Corporation, Electronics Avenue, Danvers, MA 01923, (617) 246-1600, TELEX (0650) 921819.



# WHO'S AFRAID OF TCG?



RCA, Philips-ECG and G.E., to name a few. And for good reason.

Only three years ago TCG started out with just ten parts in its line. Today we're one of the major success stories of the electronics industry, and frankly, the big guys are getting more than a little uneasy.

We've grown so rapidly because we give you more of what you're buying the other manufacturer's parts for. We test all of our parts extensively on state-of-the-art equipment during every phase of production. So you'll get more quality and our full, two year replacement warranty. And, in a time that has seen the other manufacturers adding fewer and fewer parts to their catalogs, we've added 800 new parts this year alone.

That's why more and more technicians in the know are turning to TCG's Replacement Master Guide. It cross references over 210,000 different part numbers—more than G.E., or RCA.

TCG uses a special computer controlled inventory

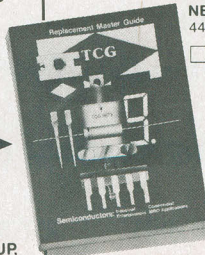
*G.E. is a registered trademark of the General Electric Company.*



NEW-TONE ELECTRONICS/  
TECHNICIAN COMPONENTS GROUP  
44 FARRAND STREET,  
BLOOMFIELD, NJ 07003

system, so when you decide to replace or design with TCG, you know you'll always be able to find the part you need on your distributor's shelf. And TCG replacement parts come in either polybags or carton packs with device type, rating limits, package diagrams and replacement equivalents right on the package. So finding the correct part for your component has never been easier, faster or more convenient.

No matter what area of electronics you're into, TCG replacement semiconductors are the parts for you.



MAIL TO:  
NEW-TONE ELECTRONICS/ TECHNICIAN COMPONENTS GROUP  
44 FARRAND STREET, BLOOMFIELD, NEW JERSEY 07003

☐ PLEASE RUSH ME THE 1982 REPLACEMENT MASTER GUIDE.

(NAME)

(ADDRESS)

(CITY)

(STATE)

(ZIP)



know because I have worked, and still work, as a Maintenance Engineer for a prominent AM/FM station in the Washington, DC area. I have lived here for close to 10 years.  
THOMAS REX OLIVER,  
Forestville, MD

## COLOR COMPUTER

I believe that Marc Stern made an error when he stated on page 51 of the October 1982 **Radio Electronics** (in the section dealing with Radio Shack's *TRS-80 Color Computer*) that "...the number-crunching capabilities of this system are slowed by its clock speed of .894 MHz."

While the CPU clock speed certainly affects the overall speed of a system, it does not tell the whole story. The *Color Computer*

can hold its own against a Radio Shack *Model III* with Z-80 Processor running at 2.03 MHz. When output to the screen is required during a benchmark test, the *Color Computer* gains almost a 2-1 advantage in speed because of the additional circuitry that it possesses to control the video. A quick glance at the benchmark article in the August 1981 issue of *Interface Age* will convince any reader that the CPU clock speed does not tell the whole story when number-crunching speed is being considered.

Another point: While it is true that a  $32 \times 16$  screen format is certainly restrictive for word-processing tasks, many word-processing programs for the *Color Computer* now come with a  $51 \times 24$  upper/lower case character generator in software.

GOLDEN RICHARD III

## CHANGES

The October 1982 issue of *Popular Electronics* announces that its name is to be changed to *Computers & Electronics*. The editorial announcing that seemed proud of the change. I regret it. There are lots of computer publications, and there will be more, but it is becoming increasingly difficult to find major publications dealing with electronics concerns not directly involved with computers. There are readers whose interests who do not revolve around computers.

I hope that a similar change will not come upon **Radio-Electronics**. Your magazine has done a lot to emphasize and clarify basic principles, and for a long time has been very useful in any number of practical ways. It has looked to the future through those means. I hope that you do not allow it to become more specialized.

CARL F. HARTMAN  
Newport Beach, CA

As we stated at the end of our October 1982 editorial: "...we do not intend to become a computer magazine. **Radio-Electronics** remains dedicated to the broad coverage of the entire electronics industry."—Editor

## STANDARDS

I would like to comment on Dane E. Erickson's letter in the July 1982 **Radio Electronics**, concerning FCC-mandated standards for teletext, color TV, and other such things.

Among my other gadgets and toys, I own a Sony Betamax VCR, a cassette tape player (several, in fact), the typewriter upon which this letter is being written, and many other things that started out by competing in a free market with devices that did the same job differently.

All of those things have prospered and survived without any government agency mandating any standards at all. In fact, the struggle between VHS and Beta videotape formats goes on as we speak. I buy Beta tapes, while the owner of a VHS machine buys VHS tapes. It is clearly to my advantage to force the VHS people, by law, to change to Beta format so that I can always find the tapes I like in my format.

However, what if VHS turns out to be a better format in the long run? What if, in five years, a new system based on presently unforeseen technology comes out? A mandatory system freezes out such advances. Color TV here, which is seen to be such a success by advocates of mandatory standards, is actually quite inferior to the PAL standards in Europe, because they froze their technology a year or two later than the U.S. did. Who can tell what standards we might enjoy today if there had been no freeze, considering how much difference a couple of years' progress in Europe made in picture quality?

If we are to engage in predictions, let me make some: Teletext will prosper unless the space is needed for other uses (like captioning). AM stereo will be used and will prosper if people care. (I don't believe that it can compete with FM, because of bandwidth limitations.) If those and other ideas fail, it will be because people do not really need them, or want them, and not because the government failed to lead us to them by the nose.

MARWAN E. NUSAIR,  
Cincinnati, OH

R-E

## PRINT THE WORLD



### See What You've Been Missing!

Stay in touch with world events, monitor weather, ship traffic, and radio amateurs. Connect to your receiver and display shortwave radio teleprinter and Morse code transmissions with the new receive-only **HAL CWR-6700 Telereader**.

- Receive ASCII or Baudot RTTY
- Six standard RTTY speeds
- 3 RTTY shifts for low or high tones
- Adjustable space for fine tuning
- Receive Morse code — 4 to 50 wpm
- 16 lines by 36 or 72 character display
- Two page video display
- Parallel ASCII printer output
- Requires +12 VDC and external TV monitor
- One year limited warranty
- Small size (8" x 3" x 12.75")

Write or call for more details. See the CWR-6700 at your favorite HAL dealer.



**HAL COMMUNICATIONS CORP.**

BOX 365

URBANA, ILLINOIS 61801

217-367-7373



# TM 500: Now one call gets it all!

**Introducing a direct order line to the complete line of TM 500 plug-ins and mainframes.** That's right. Just get on the phone to get your hands on the world's most accepted modular general purpose test instruments.

One phone call to the Tektronix National Marketing Center gets you everything you need. Fast answers from experts about applications, product selection and accessories. Pricing and ordering information.

Now these multipurpose instruments are as easy to order as they are to interface and use!

**TM 500 made configurability famous.** For years electronic engineers have been depending on TM 500 for performance that's totally reliable, totally Tektronix. Create your own personalized test system

from over 35 different plug-in instruments: DMMs, Counters, Pulse Generators, Function Generators, Amplifiers, Oscillators, Power Supplies, Oscilloscopes, Calibration Instruments, Special Purpose Plug-Ins, even Blank Plug-In Kits.

Plus a choice of six mainframes to house plug-ins: bench, rackmount and portable versions, each with built-in power supply.

Our new TM 500 Selection Guide covers the full line. Get your copy plus a complete price list by contacting your local Tektronix Sales Engineer or by calling toll free.

**Call the Tektronix National Marketing Center today!** You'll be



talking with technical personnel who can answer your questions, accept your order

and expedite delivery. Direct orders include operating manuals, 15-day return policy, full Tektronix warranty and worldwide service back-up.

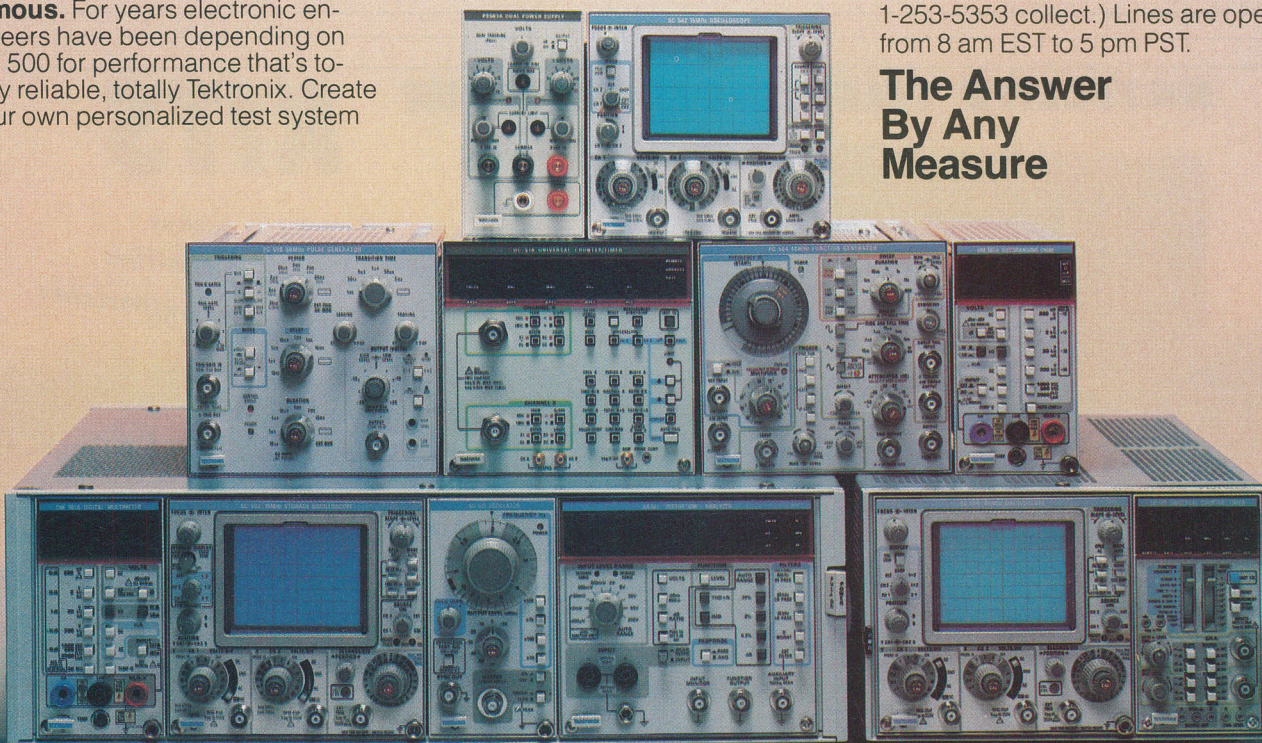
**ORDER TOLL-FREE**

**1-800-426-2200**

**Ask for Department L0146**

(In the State of Washington, call 1-253-5353 collect.) Lines are open from 8 am EST to 5 pm PST.

**The Answer  
By Any  
Measure**

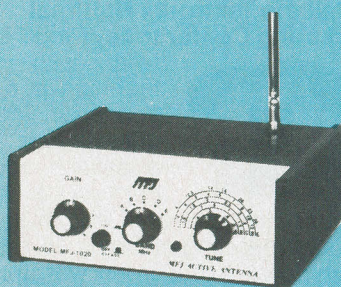


**Tektronix<sup>®</sup>**  
COMMITTED TO EXCELLENCE



# EQUIPMENT REPORTS

## MFJ Model 1020 Active Antenna



CIRCLE 101 ON FREE INFORMATION CARD

MFJ		1020									
OVERALL PRICE											
EASE OF USE											
INSTRUCTION MANUAL											
PRICE/VALUE											
	1	2	3	4	5	6	7	8	9	10	
	Poor		Fair		Good		Excellent				

LIVING IN AN APARTMENT CAN WREAK havoc on a shortwave listener's enjoyment. Usually, there's no place to string a decent antenna because of space and/or

lease restrictions, but some relief is here—at last—in the form of an indoor active antenna. It may not have the gain of a multi-wavelength long wire, tuned

dipole-antenna, or beam system, but it will still give a good account of itself.

Taking advantage of field effect and bipolar transistor technology, MFJ Enterprises (PO Box 494, Mississippi State, MS 39762) has introduced its model MFJ-1020 indoor active antenna; that device covers 300 kHz to 30 MHz in five bands.

Packaged in an attractive wood-grained and cream-colored case, it measures  $6\frac{1}{4} \times 6 \times 2\frac{3}{8}$  inches and weighs only one pound—but the manufacturer has put a lot of performance into that small unit.

The device's frequency range includes all of the international shortwave bands as well as the high-frequency amateur-radio bands. If you wish, you could also use the device as a preselector for an indoor or outdoor wire antenna.

All of that is accomplished using a

## SATELLITE TELEVISION RECEIVER

## KITS



*Rainbow makes  
a top-of-the-line  
Receiver affordable*

The Electronic Rainbow Receiver consists of a receiver with an external down-converter that mounts at the antenna, feeds the voltage to the LNA through the coax cable. The 4GHz signal is down converted to 70 MHz and is fed through the RG59/U coax to the receiver.

Rainbow Kits are supplied with simple step by step instructions. All the circuits that you need expensive test equipment to do are pre wired and tested. All printed circuit boards have the outline of each part printed on them.

### RECEIVER FEATURES

Built in RF modulator • Detent Tuning-3.7 to 4.2 GHz • Variable Audio-5.5 to 7.5 MHz • Invert Video • Channel Scan • Voltage monitoring • Meter output • Remote Tuning

### SPECIFICATIONS:

Single Conversion Image Rejection Downconverter • Threshold 8 db CNR • IF Bandwidth 24MHz • Output IV Audio and Video • IF Frequency 70MHz • Video Bandwidth 4.5MHz • Size  $3\frac{1}{2}'' \times 8\frac{1}{2}'' \times 11\frac{1}{4}''$  W

### Complete Satellite TV Receiver

#### KIT #1 — Contains:

- Mainboard • Tuning Board • Down-converter Board • Modulator Board
- All parts needed to complete receiver
- Down Converter built in case.
- Cabinet, attractive black brushed anodized metal with silk screened front and back for a professional look
- 70 MHz Filter is pre-wired and tested.
- Complete instruction Manual.

**\$395.00**

#### KIT #2 — Board Kit Contains:

- Main Board • Tuning Board • Down-converter board • Modulator Board
- Parts List, assembly and alignment manual
- 4GHz local oscillator and 70MHz filter is pre-wired and tested.

**\$129.00**

Instruction manual. Contains printed circuit board layouts, parts placement, and alignment instructions.

**\$25.00**

*Ask about  
guaranteed  
to play*

We will accept telephone orders for Visa & Mastercard  
No C.O.D. Orders

**To Order Call** 800-428-3500 317-291-7262  
Complete Kit Weighs 10 pounds. Please add Sufficient Postage  
6254 La Pas Trail  
Indianapolis, Indiana 46268

**ELECTRONIC  
RAINBOW**

146

CIRCLE 88 ON FREE INFORMATION CARD





Continuously  
variable output,  
0-150 V AC

•

Input Frequencies  
48-500 Hz

•

Up to 2 amp.  
at all voltage

•

Large taut-band  
panel voltmeter,  
3% F.S.

**Monitor ISO-V-AC WP-29**

## REDUCE SHOCK HAZARD. NEW, VARIABLE ISOLATION TRANSFORMER, ONLY \$157.75

Here's extra safety for personnel—protection for equipment. Absolutely necessary for servicing or testing any transformerless equipment—industry, lab, school or field.

New WP-29 ISO-V-AC lets you set isolated output voltage to precise

value you need. Monitor either isolated output or direct input voltage on panel meter. It's the most versatile isolation transformer you can buy!

Two isolated outputs: polarized standard two-wire socket and banana

jacks (so isolated AC may be applied directly to circuit points). Completely portable. Thermal overload protection of transformer and output protected by 2-amp. circuit breaker. Output leads supplied.

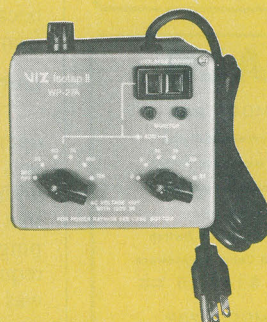
### VIZ Isotap® isolation transformers



**WP-26A Isotap**

400 VA isolated,  
500 VA direct. Outputs  
at 105, 120 and 135 V.

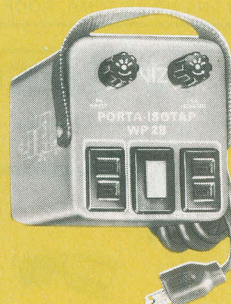
**\$85.00**



**WP-27A Isotap II**

400 VA isolated only.  
Outputs 25 to 150V AC  
in 5V steps.

**\$89.95**

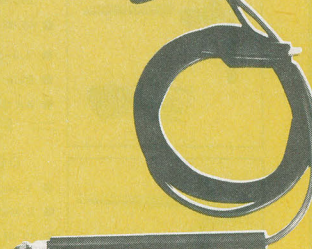


**WP-28 Porta-Isotap**

150 VA isolated, 500 VA  
direct. Output 105-130V.  
TV adapters supplied.  
Carrying strap.

**\$65.00**

### AC Leakage Tester



**WT-540B**

For safety.  
Detects AC leakage in  
appliances and equipment.  
Calibrated at 0.5  
and 0.75 mA.

**\$39.75**

#### VIZ RELIABILITY.

VIZ is a 50 year-old company. Our instruments are fully warranted, parts and labor, for a year. All units tested to NBS standards. We offer service and parts availability for a minimum of ten years. Over 15 repair depots in U.S.A.

Want full technical details and a demonstration? Call toll-free, 1-800-523-3696, for the VIZ distributor near you.

**VIZ**

**Look to VIZ for value, quality and availability.  
Over 70 instruments in the line.**

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144



## HOLIDAY SPECIALS

FROM

TRITON MARKETING CORP.

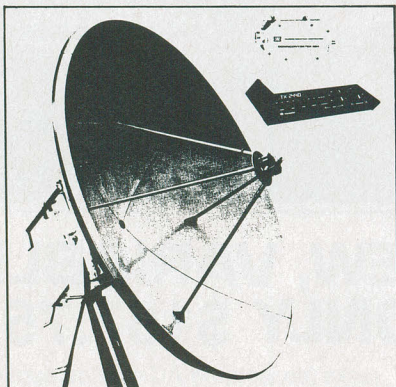
EST. 1979

SPECIAL PRICING  
GOOD UNTIL 1/31/83

... The Leader in Microwave Entertainment Devices

## EARTH STATION BONANZA

A COMPLETE HIGH QUALITY EARTH STATION  
CONSISTING OF.....



### TELECOM TX-2440 RECEIVER featuring...

Remote dual conversion down converter in a weatherproof housing, horizontal/vertical polarization switch, tunable audio with selectable bandwidth, continuous video tuning, aluminum cabinet, AFC, AGC and a 1 year warranty.

### SATELLITE SYSTEMS 10' PARABOLIC

4 piece fiberglass construction, 40dB gain, reflector weight approx. 190 Lbs., pole polar mount, hand crank adjustment, LNA mount and rotator, scalar feed horn.

AVANTEK 120<sup>0</sup> K-50 dB gain LNA.

ALL CABLE, CONNECTORS, HARDWARE and INSTRUCTIONS.

ALL FOR THE INCREDIBLE PRICE OF..... **\$ 1985.00**

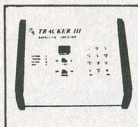
FOB NEW YORK

extra cost options



GILLASPIE 7600A

The Receiver for  
the Discriminating  
Videophile

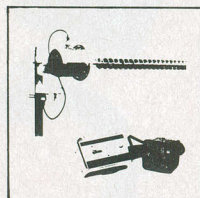


ACTUATORS

Manual  
&  
Programmable

LARGER REFLECTOR SURFACES, LOWER LNA NOISE TEMP., ROOF MOUNTED ANTENNAS

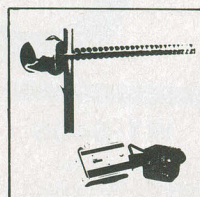
## MICROWAVE TV SPECIALS



DCV - 100

- Ideal for Medium Signal Areas
- 45 dB System Gain
- 1.9-2.7 GHz
- Built in A/B Switch
- All Cable & Hardware

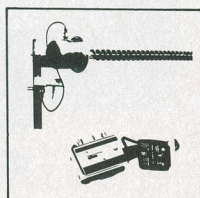
= \$ 109.95 =



DCV - 1A

- 1 pc. Metal Const.
- 2 Microwave Stages
- 53 dB System Gain
- 2.1-2.6 GHz
- Built in A/B Switch
- All Cable & Hardware

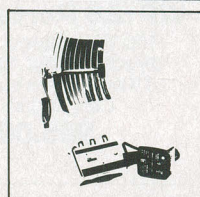
= \$ 129.95 =



MDC -23D

- Commercial Styling
- 2 Microwave Stages
- 53 dB System Gain
- 2.1-2.6 GHz
- Built in A/B Switch
- All Cable & Hardware

= \$ 149.95 =



MDC - 23P

- 3.75 sq. ft. Parabolic
- 2 Microwave Stages
- 57 dB System Gain
- 2.1-2.6 GHz
- Built in A/B Switch
- All Cable & Hardware

= \$ 169.95 =

WE CARRY A COMPLETE LINE OF CABLE TV CONVERTERS & DECODERS

TRITON MARKETING Corp.

679 REMSEN AVENUE

BROOKLYN, N.Y. 11236

TOLL FREE HOT LINE

1-800-221-6535

1-212-345-8000

We Accept Mastercard and Visa

CIRCLE 18 ON FREE INFORMATION CARD

three-transistor tuned-input amplifier circuit whose operation is simplicity itself. A signal arrives at the antenna and is coupled to a tuned circuit through one of five inductors; those are chosen using a front-panel mounted BAND selector switch. The signal is then fed to a two-transistor common source amplifier circuit made up of a pair of 2N5468's. From there, the signal is fed to a 2N5179 bipolar transistor for final amplification, and finally out to the receiver.

Setting up the device is also straightforward. Since it is an active antenna, there must be a voltage source—in this case either a 9-volt battery or a 9-volt AC adaptor with a subminiature plug. Also required are a good earth ground and a coax jumper cable between the unit and your receiver. One note about that jumper—both the input and output of the device use phono jacks, not the standard SO-239 coax connectors you might expect. Thus, at least one end of the jumper will have to be fitted with a phono plug. Personally I would have preferred to see SO-239 connectors used here as they are less likely to be accidentally disconnected. MFJ does use them on several of their other products.

Once all of the connections are made, and you've tuned your receiver so that you are receiving a signal, set the antenna's GAIN control to about midrange and adjust the TUNE control for the maximum reading on the receiver's S-meter. If the signal level isn't high enough, you may find that you'll have to adjust the GAIN control to maximum and then adjust it to the proper level. Be careful that you don't leave the device's gain too high, because that could overload the receiver's front end.

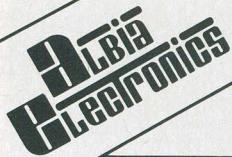
### Our test

The first thing we noticed when we opened the carton was how well the unit was packed—certainly well enough to withstand the vigorous rough handling that it is likely to encounter during shipping. Once unpacked, very little time is required to set up the unit—in our case, it was operational less than one hour after opening the carton.

Of course, the important thing is how well it works. In a word, the results were amazing. When used with a receiver with poor sensitivity, the device improved that sensitivity by several orders of magnitude. On another receiver, not only did it help with sensitivity, it also improved selectivity as, with proper tuning, unwanted signals could be notched out. In fact, the active antenna tunes so sharply that the first few times you use the unit you'll find it easy to miss signals. Before long, however, the tuning procedure will become second nature.

As mentioned earlier, the device can also be used as a preselector for an indoor or outdoor wire antenna. While we didn't use it for that purpose very much, we did



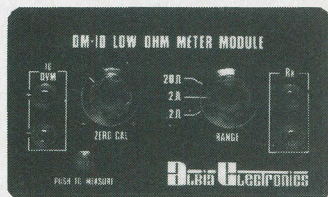


# thanksgiving dollar days

ORDER BEFORE DEC. 15th  
AND GET A FREE GIFT! 1-800-243-6953

## LOW OHM METER MODULE, DM-10

Measures resistance from 10 milliOhms to 20 Ohms. Now you can measure resistance down to 10 milliOhms with this low cost, easy to use DVM module. Check coil resistance, transformers, relays, chokes, printed circuit board copper paths and ground cables. Special zero balance control nulls out input cable resistance to insure accurate readings. Your DVM has to be set to 2V range during operation.

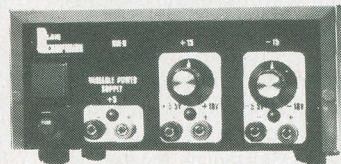


- Resistance range 10 milliOhms to 20 Ohms
- Zero Calibration control
- Battery powered (push to read battery saver circuit). Requires 9 Volt Battery (not included)
- Size 6.25" x 3.75" x 2"
- Incl. Model 336 Test Clips

**\$55<sup>95</sup>**

CALL ABOUT THE SPECIAL OF THE DAY!

## REGULATED TRIPLE POWER SUPPLY, LOW PRICED! DM-6

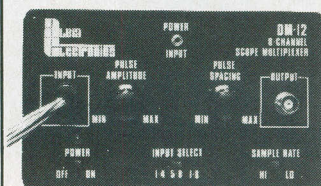


A fully assembled and tested triple benchtop power supply. Includes fixed 5V @ 1 Amp, 5V to 15V @ 0.5 Amp and -5V to -15V @ 0.5 Amp—all supplies regulated, short proof. Each supply has a power on indicator LED. Complete and ready for use in a durable (8" x 6" x 3 1/2") metal case.

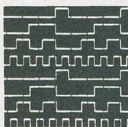
**\$99<sup>95</sup>**

## 8 CHANNEL SCOPE MULTIPLEXER, DM-12

Convert your single channel scope into a 4 or 8 channel instrument; just connect the DM-12, 8 channel scope multiplexer to your scope, clip the 8 input probes to the signals you want to view. Simple, easy, fast—can handle logic level TTL signals from DC to 3MHz. Features separate spacing and trace amplitude controls and selectable sampling rate—all to insure easy clear scope display.



COMPLETELY ASSEMBLED AND TESTED! READY TO USE!



VIEW 8 CHANNELS AT ONCE!

**\$74<sup>95</sup>**

- 8 TTL compatible input channels (1 TTL load per channel) can drive 50 Ohm scope cable.
- Maximum full screen amplitude 1.6 Volts adjustable.
- Trace amplitude and spacing controls.
- 4 or 8 channel selector switch.
- 8 color coded input cable, 24" long with insulated alligator clips.
- External 9 VDC power supply included (Model MMAC-2).
- Size 6.25" x 3.75" x 2"
- BNC Output Cable Accessory (Model PSA-2 add \$14.95).

## LOW COST CAPACITANCE METER MODULE, DM-8



Connect this high quality low cost Capacitance Meter Module, DM-8 to your digital Volt Meter and turn it into a Digital Capacitance Meter—the Low Cost Way!

COMPLETELY ASSEMBLED AND TESTED! READY TO USE!

**\$79<sup>95</sup>**

- 2V Output
- Accuracy better than 5%
- Push to read range (button) from 1 pF to 20,000  $\mu$ F
- Zero Calibration control
- In one easy to use, self-contained package
- Battery powered, with "push to read" battery saver circuit (9V batteries not included)
- Size 6.25" x 3.75" x 2"
- Includes Model 336 Test Clips

## PORTABLE SELF-CONTAINED CIRCUIT DESIGNER, DM-5

Contains 8 LEDs and 8 logic switches.

- Control switches and buffered LED logic indicators
- Plug your ICs into solderless breadboards, tie in power and ground, connect your logic switches and LED indicators



Also available in 4 LEDs and 4 logic switches. MODEL DM-5A

- All interconnections between LEDs, switches and circuits via 22-26 solid wire
- Self-powered, in compact, durable carrying case
- Battery (4 1 1/2 Volt C cells\*) or AC powered providing economical bench use or convenient portable use. Available in two models.

**\$69<sup>95</sup>**

\*Batteries not included

MENTION THIS MAGAZINE AND GET A FREE GIFT!

## LOW COST HIGH FREQUENCY COUNTER



MODEL NO. DM-7

The Albia Model DM-7, 8 Digit High Frequency Counter is easy to use, switch selectable time base input by a single BNC, nothing to build!

- 5 Hz to 550 MHz
- 8 big easy-to-read 43" high intensity LED display
- Crystal ( $\pm 3$  ppm @ 25°C) controlled 0.1 or 1.0 sec. gate times
- Convenient benchtop size (7"x10"x3") durable attractive case

COMPLETELY ASSEMBLED PRE-TESTED

**\$149<sup>95</sup>**

PRICES & SPECIFICATIONS SUBJECT TO CHANGE • SPECIAL ENDS DEC. 30th



VISA

FOR FASTER SERVICE USE YOUR CREDIT CARD.

**Albia Electronics**

44 KENDALL STREET  
NEW HAVEN, CT. 06512



ALBIA'S FAMOUS WARRANTY.

**CALL TOLL FREE 1-800-243-6953**

9 AM  
5 PM  
EST

CIRCLE 15 ON FREE INFORMATION CARD



make it a point to try it out and found that it is indeed useful in bringing a signal out of the noise.

Speaking of noise, one thing that must be remembered is that the unit will not only increase signal strength, but also the noise level in the receiver. That is particularly noticeable on the lower frequencies but, while it can get a bit bothersome at times, it is usually not enough of a problem to interfere with reception. Another and potentially more serious drawback is that the device is sensitive to man-made interference from such things as fluorescent lights and electric motors; of course the same would be true of almost any other antenna system that is located en-

tirely indoors.

The four-page instruction sheet includes all the information a user needs to have the device up and working in as little time as possible. Clearly and concisely written, it includes a schematic of the unit and a PC board component layout. The only problem with those instructions is that it provides little theory—a rather noticeable omission anyone who is the technically inclined.

Overall, however, the MFJ model *MFJ-1020* active antenna works as claimed, and is a good buy at its price of \$79.95. It is especially recommended for anyone who needs, but cannot erect, a full-size outdoor antenna. **R-E**

Be a VIC expert! Our VIC 20 PROGRAMMERS REFERENCE GUIDE provides you with a complete VIC 20 BASIC vocabulary guide, a section on machine-language programming, another on VIC 20 input/output operations, and hundreds of tips on improving your programming skills! Ask for No. 21948, only \$16.95.

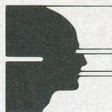
Speak Sinclair fluently with practical, usable BASIC programming help from Sams ZX-81 BASIC BOOK, No. 21957, for only \$12.95. Continue the conversation, in Sinclair machine code this time, with ZX-81 USER'S HANDBOOK, a useful reference that also teaches you the details of ZX-81 hardware and interfacing, and more. Ask for No. 22012, only \$13.95 (tentative).

Learn to use beginning and advanced BASIC on your Commodore 64 computer with Sams COMMODORE 64 USER'S GUIDE. Also shows how to create arcade-type color animation, including music and sound effects! Same book that comes packed with

every Commodore 64 computer. Ask for No. 22010, only \$12.95.

Once you know a little BASIC, you can use your computer to play checkers, predict human choices, make deductions from stored data, generate poetry, and simulate counseling by a psychiatrist! EXPERIMENTS IN ARTIFICIAL INTELLIGENCE FOR SMALL COMPUTERS shows you how, and helps you translate the programs into the BASIC version you need. Ask for No. 21785, only \$6.95.

To order these Sams Books or to get the name of your local Sams retailer, call 800-428-3696 toll-free or 317-298-5566 and refer to our ad #AD220.

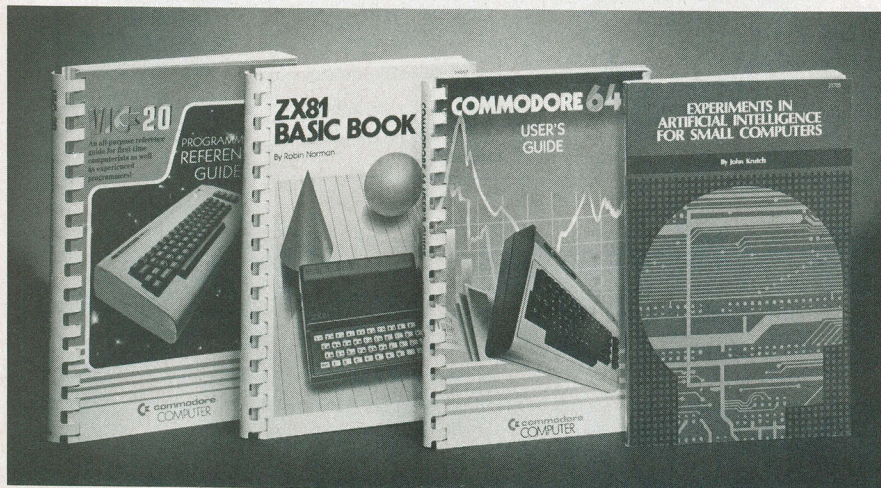


TM

**SAMS BOOKS**

HOWARD W. SAMS & CO., INC.  
4300 West 62nd Street  
P.O. Box 7092  
Indianapolis, IN 46206

## SAMS BRINGS YOU BASIC ANSWERS FOR COMMODORE AND SINCLAIR



Offer good in USA only and expires 3/31/83. Prices subject to change without notice.

CIRCLE 20 ON FREE INFORMATION CARD

### Sanwa Model LCD-900 Multimeter



CIRCLE 102 ON FREE INFORMATION CARD

Sanwa	LCD-900									
OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE/VALUE										
	1	2	3	4	5	6	7	8	9	10
Poor										
Fair										
Good										
Excellent										

BOTH ANALOG AND DIGITAL MULTIMETERS have been the workhorse in shops and on the bench for quite some time now. One common complaint associated with analog units, however, has been that the multiple scales make reading the device difficult at times. There have been several attempts to solve that problem, but the most novel approach I've seen is featured on the Sanwa model *LCD-900*.

That unit appears to be a standard analog multimeter, at least at first glance. It measures DC voltage in seven ranges, from 1- to 1000-volts full scale; AC voltage in five ranges, from 10- to 1000-volts full scale; resistance in four ranges, from 1000-ohms to 1-megohm full scale, and DC current in four ranges, from 300-microamps to 300-milliamps full scale. AC current is measured on one 0- to 3-amp scale. The meter's sensitivity is specified as 50,000-ohms-per-volt DC and 10,000-ohms-per-volt AC.

But one thing does appear amiss, however, when you first open the carton. The meter's face is completely blank. That's because an LCD is used there. Turn the meter on, with the range-selector switched to any range, and only the scale for that range appears. Neat—no more figuring out which range you're supposed to be reading as only one range is visible at one time. The LCD's readability is good, and the bright orange pointer is easy to spot against the display.

Panel markings are nice and clear. The



## SWD-1 VIDEO CONVERTER

### FOR CABLE TV



The SWD-1 Video Converter is utilized on cable TV systems to remove the KHz's signal from a distorted video (channel 3 in/out) and also pass thru the normal undistorted/detected audio signal. Rocker switch selects operating mode to remove KHz's distortion from the video or pass all other channels normally. Simple to assemble—less than 30 minutes. Pre-tuned. Input/output Channel 3. Impedance 75 ohms. 117VAC.

SWD-1 Video Converter Kit ..... \$69.95

## VTR ACCESSORIES

### SIMPLE SIMON VIDEO STABILIZER

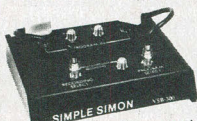


Simple Simon Video Stabilizer, Model VS-125, eliminates the vertical roll and jitter from "copy guard" video tapes when playing through large screen projectors or on another VTR. Simple to use, just adjust

the lock control for a stable picture. Once the control is set, the tape will play all the way through without further adjustments. Includes 12V power supply.

VS-125 Video Stabilizer, wired ..... \$54.95

### SIMPLE SIMON VIDEO SWITCHING BOX



#### The Affordable Video Control Center

Excellent in isolation and no loss routing system. Simple Simons VSB-300 Video Switching Box enables you to bring a variety of video components together for easy viewing/dubbing. Also you gain the ability to record one channel while viewing another. Unit includes two F-type quick connector ended cables.

VSB-300 Video Switching Box, wired ..... \$19.95

## UHF ANTENNAS and ACCESSORIES

### MDS-AMATEUR-ETV 32 ELEMENT YAGI ANTENNA

- Not A Kit
- 1.9-2.5 GHz
- 38 1/2" Long
- 23dB Average Gain
- Commercial Grade
- Die Cast Waterproof Housing with 4 1/4" x 2 1/2" Area for Electronics
- Includes P.C. Probe, F-61 Connector and Mounting Hardware

MAE-2 32 Element YAGI Antenna ..... \$23.95

### Kato Sons' Down Converter Kit ★1.9 - 2.56GHz★

Designed for Simple Simon by former Japanese CQ Amateur Magazine's UHF Editor/Engineer. Unit utilizes new ingenious Printed Circuit Probe for maximum gain. Circuit board fits inside MAE-2 antenna housing. Requires 1 hour assembly. IC and capacitors pre-soldered.

Model KSDC-KIT 1.9 - 2.56GHz Down Converter Kit ..... \$34.95

### Kato Sons' Regulated Variable DC Power Supply

For use with KSDC-KIT 1.9 - 2.56GHz Down Converter. Completely assembled with Attractive Cabinet, TV/Converter Mode Switch, Frequency Control and LED Indicator.

Model KSPS-1A Assembled Power Supply ..... \$23.95

**SPECIAL INTRODUCTORY SAVINGS**

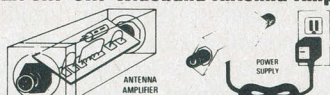
### ORDER ALL THREE ITEMS

MAE-2, KSDC-KIT and KSPS-1A for Only **\$74.95**

Regular price if ordered separately \$82.85

— CO-AX CABLES ARE NOT INCLUDED —

## ZYZZX VHF-UHF Wideband Antenna Amplifier



### Revolutionary New HYBRID IC Broadband Amplifiers

50 MHz - 900 MHz

Model ALL-1 12dB Gain

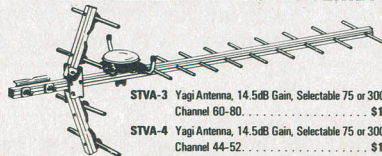
Model ALL-2 35dB Gain

These units are not available anywhere else in the world. Each unit will serve many purposes and is available in Kit or Assembled form. Ideal for outdoor or indoor use. I/O impedance is 75 ohms. Amplifiers include separate co-ax feed power supply. Easily assembled in 25 minutes. No coils, capacitors to tune or adjust.

ALL-1 Complete kit w/ power supply ..... \$24.95 ALL-1 Wired/ Tested w/ pwr supply ..... \$34.95

ALL-2 Complete kit w/ power supply ..... \$4.95 ALL-2 Wired/ Tested w/ pwr supply ..... \$4.95

## Our New STVA 14.5dB GAIN, 14 ELEMENT CORNER REFLECTOR YAGI ANTENNA



STVA-3 Yagi Antenna, 14.5dB Gain, Selectable 75 or 300 ohm Channel 60-80. .... \$19.95

STVA-4 Yagi Antenna, 14.5dB Gain, Selectable 75 or 300 ohm Channel 44-52. .... \$19.95

RG-59/U 75 ohm Low Loss Coax Cable. .... \$12p/ft. F-59 Coax Connector. .... \$3.95 ea.

MT-1 Special UHF 75-300 ohm Matching Transformer ..... \$1.45 ea.

# Switch to Bambi!™

## Electronically

Bambi Electronic Video Switch ... makes switching of your VCR/VTR, Pay TV Decoders, Cable TV, Video Discs, Video Games, Closed Circuit TV, Antennae and Microcomputer as easy as pushing buttons.

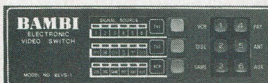
The Bambi Electronic Video Switch is an electronic switching network which can accept up to six different sources of video signals and provide the flexibility of directing the inputs to any or all of the three outputs.

Now you can eliminate ... the drudgery of disconnecting and reconnecting your video equipment each time you use it ... the tangled mess of cables which are impossible to trace out ... not being able to use more than one function at a time.

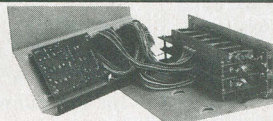
Bambi lets you enjoy using your video equipment the way it should be ... electronically and on line at the push of a button.

Model BEVS-1 Wired

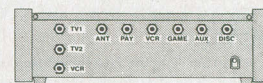
**\$129.95**



Bambi's front panel was designed with the user in mind. Computer styled construction, with soft-touch keyboard (rated for over 10 million operations), arranged in matrix form allows easy input/output selection without referring to charts. Functions selected through the keyboard are immediately displayed on the 18 LED status indicators.



Check the quality of Bambi against that of much higher priced competition. All solid state electronic switching provides low attenuation (3dB), wide frequency response (40-890 MHz), and excellent isolation between signal sources (each I/O section individually shielded for 65dB min. isolation).



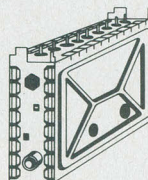
#### Bambi's Specifications:

- Input/Output Impedance 75 ohm
- Signal Loss 3dB ±1dB
- Noise 4dB ±1dB
- Input Return Loss 12dB min.
- Isolation 65dB min.
- Power Req. 117VAC 60 Hz, 2W
- Dimensions 10 1/4" W x 6 1/4" D x 3 1/4" H
- Weight 4 1/2 lbs

## 7+11 SWD PARTS KITS

### MITSUMI VARACTOR UHF TUNER Model UES-A56F \$24.95

Freq. Range UHF470 - 889MHz  
Antenna Input 75 ohms  
Channels 14-83 Output Channel 3



KIT NO	PART NO	DESCRIPTION	PRICE
1	VT1-SW	Varactor UHF Tuner, Model UES-A56F	\$24.95
2	CB1-SW	Printed Circuit Board, Pre-Drilled	18.95
3	TP7-SW	P.C.B. Potentiometers, 1-20K, 1-1K, and 5-10K ohms, 7-pieces	5.95
4	FR35-SW	Resistor Kit, 1/4 Watt, 5% Carbon Film, 32-pieces	4.95
5	PT1-SW	Power Transformer, PRI-117VAC, SEC-24VAC, 250ma	6.95
6	PP2-SW	Panel Mount Potentiometers and Knobs, 1-1KBT and 1-5KAT w/Switch	5.95
7	SS14-SW	IC's 7-pcs, Diodes 4-pcs, Regulators 2-pcs Heat Sink 1-piece	29.95
8	CE9-SW	Electrolytic Capacitor Kit, 9-pieces	5.95
9	CC33-SW	Ceramic Disk Capacitor Kit, 50 W.V., 33-pieces	7.95
10	CT-SW	Variable Ceramic Trimmer Capacitor Kit, 5-65pfd, 6-pieces	5.95
11	L4-SW	Coil Kit, 18mhs 2-pieces, 22µhs 1-piece (prewound inductors) and 1 T37-12 Ferrite Torroid Core with 3 ft. of #26 wire	5.00
12	ICS-SW	I.C. Sockets, Tin inlay, 8-pin 5-pieces	1.95
13	SR-SW	Speaker, 4x6" Oval and Prepunched Wood Enclosure	14.95
14	MISC-SW	Misc. Parts Kit Includes Hardware, (6/32, 8/32 Nuts, & Bolts), Hookup Wire, Ant. Terms, DPDT Ant. Switch, Fuse, Fuseholder, etc.	9.95
When Ordering All Items, (1 thru 14), Total Price			139.95

## 7+11 PWD PARTS KITS

### INTRODUCING OUR 7+11 PWD PARTS KITS



KIT No	PART NO	DESCRIPTION	PRICE
1	1VT1-PWD	Varactor UHF Tuner, Model UES-A56F	\$24.95
2	2CB1-PWD	Printed Circuit Board, Pre-drilled	18.95
3	3TP11-PWD	PCB Potentiometers 4-20K, 1-5K, 2-10K, 2-5K, 1-1K, and 1-50K (11 pieces)	8.95
4	4FR-31-PWD	Resistor Kit, 1/4W, 5% 29-pcs, 1/2 W 2-pcs	4.95
5	5PT1-PWD	Power Transformer, PRI-117VAC, SEC-24VAC at 500ma	9.95
6	6PP2-PWD	Panel Mount Potentiometers and Knobs, 1-1KBT and 1-5KAT with switch	5.95
7	7SS17-PWD	IC's 7-pcs, Diodes 4-pcs, Regulators 2-pcs Transistors 2-pcs, Heat Sinks 2-pcs	29.95
8	8CE14-PWD	Electrolytic Capacitor Kit, 14-pieces	6.95
9	9CC20-PWD	Ceramic Disk Capacitor Kit, 50 WV, 20-pcs	7.95
10	10CT5-PWD	Variable Ceramic Trimmer Capacitor, 5-65pfd, 5-pieces	4.95
11	11L5-PWD	Coil Kit, 18mhs 3-pcs, 22µhs 1-piece (prewound inductors) and 2 T37-12 Ferrite Torroid cores with 6 ft. #26 wire	6.00
12	12ICS-PWD	IC Sockets, Tin inlay, 8 pin 4-pcs, 14 pin 1-pc and 16 pin 2-pcs	2.95
13	13SR-PWD	Enclosure with PM Speaker and Pre-drilled Backpanel for mounting PCB and Ant. Terms	14.95
14	14MISC-PWD	Misc. Parts Kit, Includes Hardware, (6/32, 8/32 Nuts & Bolts), Hookup Wire, Solder, Ant. Terms DPDT Ant. Switch, Fuse, Fuseholder, etc.	9.95
15	15MC16-PWD	Mylar Capacitors, 14-pcs and Silver Mica Capacitors 2-pieces	7.95
When Ordering All Items, (1-15), Total Price			159.95

## SIMPLE SIMON ELECTRONIC KITS, Inc.

3871 S. Valley View, Suite 12, Dept. R, Las Vegas, NV 89103

NEED 8 OR MORE OF AN ITEM? WRITE FOR QUANTITY DISCOUNTS

In Nevada Call: 702-871-2892

**1-800-782-3716**

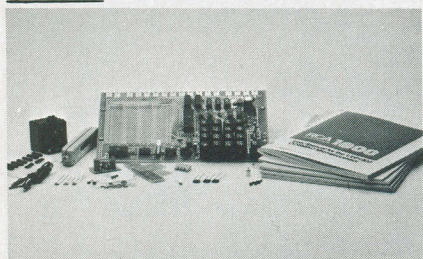
Outside Nevada Call:

Available by Mail Order Only  
Send Check\* or Money Order. Minimum Order: \$16.95. Add 10% Shipping and Handling on orders under \$40.00. For orders over \$40.00, add 5%. Minimum Shipping and Handling \$2.00. Cat. \$1.00 — VISA and Mastercard Acceptable — \*Check orders will be held 30 days before shipping.



# WE TAKE YOU BY THE HAND!

You'll learn all about computers: how to build, program, service, even play TV games—without knowing the first thing about it!



## The New ELF II "Beginners" Package

Your own expandable micro-computer kit, 5 diagnostic analyzers plus circuit, programming, diagnostic manuals, even games you can play on TV. All only \$139.95.

Even if you don't know bits from bytes, now it's easy and inexpensive to build your own micro-computer, learn how it works, program it, service it—even play games with it on your TV! It's here in the New ELF II "Beginners" Package, only from Netronics. Only \$139.95. Here's the package: 1. your own micro-computer, the famous ELF II (featuring the RCA 1802 CMOS microprocessor) in kit form with step-by-step instructions on how to build it. Diagnostic Analyzers including 2. your own Logic Probe, 3. Pulse Catcher, 4. 8 bit Test Register, 5. Logic Analyzer, 6. Gate Arrays, 7. Non-Technical Manuals on how to use analyzers, how to get into the guts of the computer, what makes it tick, how to service it. 8. Sample Programs that teach you machine language programming plus how to correct or "debug" any programming mistakes. 9. TV games you can play. If your TV set has no video input, an optional converter (RF Modulator), is available. Then, once you've got this "Beginners" Package under your belt, keep on expanding your ELF II with additions like the Typewriter Key Board, added RAM, Full Basic Interpreter, Electric Mouth Talking Board, Color/Music, A/D-D/A Boards for Robot Controls and much, much more. We'll take you by the hand with the New ELF II "Beginners" Package. Only \$139.95. Mail or phone in your order today and begin.

### Specifications: ELF II "Beginners" Package

The computer features an RCA CMOS 1802 8 bit microprocessor addressable to 64K bytes with DMA, interrupt, 18 Registers, ALU, 256 byte RAM expandable to 64K bytes. Professional-Hex keyboard, fully decoded so there's no need to waste memory with keyboard scanning circuits, built-in power regulator, 5 slot plug-in expansion BUS (less connectors), stable crystal clock for timing purposes and a double-sided, plated through PC Board plus RCA 1861 video IC to display any segment of memory on a video monitor or TV screen along with the logic and support circuitry you need to learn every one of the RCA 1802's capabilities. The diagnostic analyzers aid in understanding and trouble shooting your ELF II, as well as other computer and microprocessor products.

Continental U.S.A. Credit Card Buyers Outside Connecticut

**CALL TOLL FREE 800-243-7428**

To Order From Connecticut or For Technical Assistance, Etc.,

Call (203) 354-9375

**NETRONICS R&D LTD.** Dept. RE 32  
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

- ☐ ELF II "Beginners" Kit ..... \$139.95
- ☐ RF Modulator ..... \$ 8.95

Plus \$3.00 for postage, handling and insurance  
(\$6.00 Canada)

Connecticut Residents add sales tax

Total Enclosed \$

- ☐ Personal Check ☐ Cashier's Check/Money Order
- ☐ Visa ☐ Master Charge (Bank No. \_\_\_\_\_)

Acct. No. \_\_\_\_\_

Signature \_\_\_\_\_ Exp. Date \_\_\_\_\_

Print

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

input jacks here are rather interesting. The negative jack is the same for all of the meter's functions. The positive jack is used for all ranges except the 0- to 3-amp AC range; that range uses a separate input. A nice touch is that the leads need not be unhooked and reversed to reverse the polarity of the readings. The ON/OFF switch has a provision that will switch the polarity of the readings. What's interesting, however, is the jack marked OUTPUT. Long ago, we tuned up old radios by connecting an AC voltmeter to their audio output, using a blocking capacitor to "block off" the high DC voltage often present. That is what is done here; that jack is wired in series with an internal 0.47-μF, 600-volt capacitor.

The meter requires two batteries for operation—1.5 volts for resistance readings, and 9 volts to power the LCD display. The display is driven by a CD4047AE IC. Battery life is good, although you might run them down just playing with this ingenious little instrument. Seriously, though, the automatic scale-ranging is really quite nice and a pleasure to use.

Soltec (11684 Pendleton Street, Sun Valley, CA 91352) is the exclusive agent for the Sanwa line of analog and digital multimeters. The Sanwa LCD-900 is available from your local distributor and lists for \$139.00. **R-E**

converted portable typewriters. One notable exception to that general rule is the TP-1 from Smith Corona (65 Locust Ave., New Canaan, CT 06840). That unit, which carries a price of under \$900, is from start to finish a commercial-quality daisy-wheel printer.

The printer measures 6.4 × 12.4 inches and weighs 18.5 pounds. A hinged plate that serves as the paper support also doubles as a dust cover when it is folded flat. A fan built into the rear of the printer provides cooling.

The power switch and a Centronics-type connector are located on the rear apron. A small control panel on the front has the power lamp and a top-of-form positioning switch; that switch is used for positioning continuous-feed paper. Note, however, that at the present time the printer is unable to handle either tractor- or pin-feed forms. You can use friction-feed forms, but be prepared to monitor the printing closely, as that type of form tends to wander across the platen. In fact, the instruction manual warns against the use of that type of paper. So, in the meantime, the printer appears best for printing single sheets in an office-type situation.

The printer is available with a choice of either 10 or 12 pitch (characters-per-inch), and either parallel or RS-232C serial interface. The pitch and interface must both be chosen at the time of purchase. Printwheels with many of the more popular type-styles are available in both pitch and sizes.

The parallel interface has signal lines for 7 data bits, as well for STROBE, BUSY, and ACKNOWLEDGE. The serial interface has selectable baud rates, ranging from 50 to 19,200 bits-per-second—just about any conceivable baud rate ever used for personal and commercial computer equipment can be selected using jumpers on the interface PC-board. The serial interface can generate and acknowledge the following signals: RT (Request To Send/printer is ready), CTS (Clear To Send/computer is ready to send), and DTS (Data Terminal Ready/busy).

The printer mechanism accommodates paper widths to 13 inches, printing unidirectionally at 12 characters-per-second, which works out to approximately 120 words-per-minute. Just like a typewriter, at the end of each line, the carriage returns to the left for the start of the next line. The line spacing can be set manually for 6, 4.5, or 3 lines-per-inch. There is no provision to allow for program control of the line spacing; once set, it remains that way until changed manually.

Essentially, all the paper handling is done by an uncomplicated typewriter-style mechanism, with the usual end-roller knobs, paper release, paper bail with calibrations, and paper guide. The margins and the tabs, on the other hand, are under full program control, and can be set using PRINT statements from BASIC.

*continued on page 38*

## Smith Corona Model TP-1 Daisy Wheel Printer



**CIRCLE 103 ON FREE INFORMATION CARD**

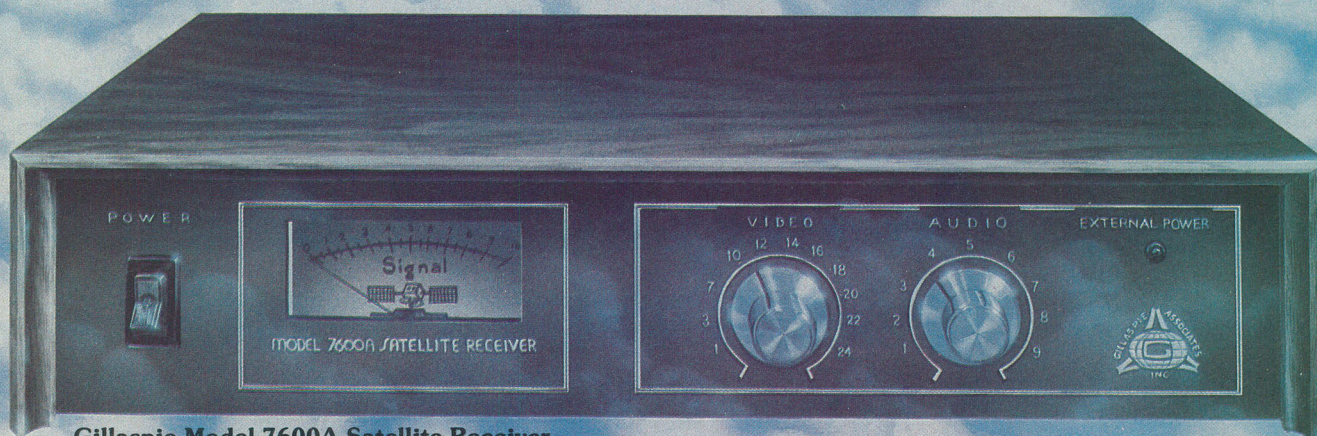
Smith Corona					TP-1				
OVERALL PRICE									
EASE OF USE									
INSTRUCTION MANUAL									
PRICE / VALUE									
	1	2	3	4	5	6	7	8	9 10
	Poor		Fair		Good				Excellent

MOST DAISY-WHEEL PRINTERS IN THE under-\$1000 price category are simply



# GILLASPIE

## IMPROVES YOUR IMAGE . . .



**Gillaspie Model 7600A Satellite Receiver**

Engineered to meet your highest specifications in audio and video satellite receiving. Backed by dependable and authoritative factory service, to assist you in reliable installations.

Whether your needs are cable, industrial, multi-terminal or home satellite receiving, Gillaspie products will earn your confidence.

### **GILLASPIE DISTRIBUTORS**

North American Satellite  
4873 North Blackstone  
Fresno, California 93726  
(209) 227-0171

Nevada Satellite  
4092 Olive  
Las Vegas, Nevada 89104  
(702) 452-5509  
(702) 452-6975

Satellite Communications, Corp.  
Kiro Corner  
Silverlake, Kansas 66539  
(800) 255-2408

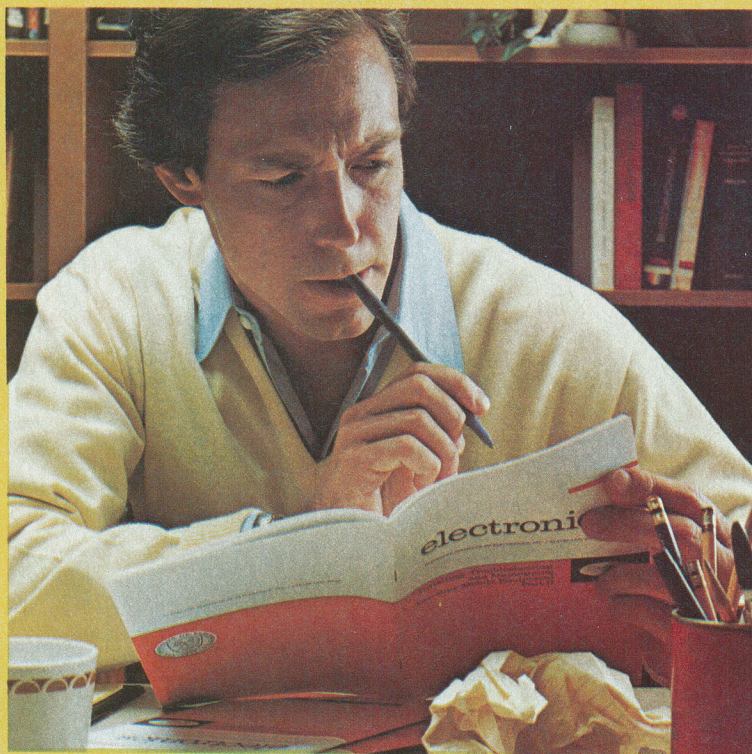
Multivision  
1001 Kingston Pike  
Knoxville, Tennessee 37922  
(615) 691-9087

**(408) 730-2500**

GILLASPIE & ASSOCIATES INC., 365 SAN ALESO AVE., SUNNYVALE, CA 94086  
CIRCLE 91 ON FREE INFORMATION CARD



**Learning  
electronics  
is no picnic.**



**At any level it  
takes work and  
a few sacrifices.  
But with CIE,  
it's worth it.**



Whoever said, "The best things in life are free," was writing a song, not living a life. Life is not just a bowl of cherries, and we all know it.

You fight for what you get. You get what you fight for. If you want a thorough, practical, working knowledge of electronics, come to CIE.

You can learn electronics at home by spending just 12 hard-working hours a week, two hours a day. Or, would you rather go bowling? Your success is up to you.

At CIE, you *earn* your diploma. It is not handed to you simply for putting in hours. But the hours you do put in will be on your schedule, not ours. You don't have to go to a classroom. The classroom comes to you.

### Why electronics training?

Today the world depends on technology. And the "brain" of technology is electronics. Every year, companies the world over are finding new ways to apply the wonders of electronics to control and program manufacturing, processing...even to create new leisure-time products and services. And the more electronics applications there are, the greater the need will be for trained technicians to keep sophisticated equipment finely tuned and operating efficiently. That means career opportunities in the eighties and beyond.

### Which CIE training fits you?

Beginner? Intermediate? Advanced? CIE home study courses are designed for ambitious people at all entry levels. People who may have:

1. No previous electronics knowledge, but do have an interest in it;
2. Some basic knowledge or experience in electronics;
3. In-depth working experience or prior training in electronics.

You can start where you fit and fit where you start, then go on from there to your Diploma, FCC License and career.

### Many people can be taught electronics.

There is no mystery to learning electronics. At CIE you simply start with what you know and build on it to develop the knowledge and techniques that make you a specialist. Thousands of CIE graduates have learned to master the simple principles of electronics and operate or maintain even the most sophisticated electronics equipment.

### CIE specializes exclusively in electronics.

Why CIE? CIE is the largest independent home study school that specializes exclusively in electronics. Nothing else. CIE has the electronics course that's right for you.

Learning electronics is a lot more than memorizing a laundry list of

facts about circuits and transistors. Electronics is interesting! It is based on recent developments in the industry. It's built on ideas. So, look for a program that starts with ideas and builds on them. Look to CIE.

### Programmed learning.

That's exactly what happens with CIE's Auto-Programmed® Lessons. Each lesson uses famous "programmed learning" methods to teach you important principles. You explore them, master them completely, before you start to apply them. You thoroughly understand each step before you go on to the next. You learn at your own pace.

And, beyond theory, some courses come fully equipped with electronics gear (the things you see in technical magazines) to actually let you perform hundreds of checking, testing, and analyzing projects.

### Experienced specialists work closely with you.

Even though you study at home, you are not alone! Each time you return a completed lesson, you can be sure it will be reviewed, graded and returned with appropriate instructional help. When you need additional individual help, you get it fast and in writing from the faculty technical specialist best qualified to

answer your question in terms you can understand.

### CIE prepares you for your FCC License.

For some jobs in electronics, you must have a Federal Communications Commission (FCC) License. For others, some employers tend to consider your license a mark in your favor. Either way, your license is government-certified proof of your knowledge and skills. It sets you apart from the crowd.

More than half of CIE's courses prepare you to pass the government-administered exam. In continuing surveys, nearly 4 out of 5 graduates who take the exam get their licenses! You can be among the winners.

### Associate Degree

Now, CIE offers an Associate in Applied Science Degree in Electronics Engineering Technology. In fact, all or most of every CIE Career Course is directly creditable towards the Associate Degree.

### Today is the day. Send now.

Fill in and return the postage-free card attached. If some other ambitious person has removed it, cut out and mail the coupon. You'll get a FREE school catalog plus complete information on independent home study. For your convenience, we'll try to have a CIE representative contact you to answer any questions you may have.

Mail the card or the coupon or write CIE (mentioning name and date of this magazine) at: 1776 East 17th Street, Cleveland, Ohio 44114.



Pattern shown on oscilloscope screen is simulated.

**CIE** Cleveland Institute of Electronics, Inc.  
1776 East 17th Street, Cleveland, Ohio 44114

Accredited Member National Home Study Council

☐ **YES...** I want to learn from the specialists in electronics — CIE. Send me my FREE CIE school catalog...including details about the Associate Degree program...plus my FREE package of home study information.

Print Name \_\_\_\_\_

Address \_\_\_\_\_ Apt. \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Age \_\_\_\_\_ Phone (area code) \_\_\_\_\_

Check box for G.I. Bill bulletin on Educational Benefits: ☐ Veteran ☐ Active Duty

**MAIL TODAY!**

RE-50



## EQUIPMENT REPORTS

continued from page 32

If the word-processing software being used permits inserting ASCII control codes from within the program, the tabs and margins can be varied during the printout. If the software does not permit the insertion of control codes, the margins must be set through BASIC before running the word processor.

The unit can print 85 of the 128 ASCII codes and characters. It ignores the character codes for the caret (up arrow), accent grave, or tilde, and spaces for the "less than" (<) and "greater than" (>) symbols, the reverse slash, left brace, right brace, and broken vertical bar. One serious drawback with the printer is that many of the non-printing characters are used in BASIC program listings, and while the ones that generate a space can be written in by hand later, that is difficult to do for the ones that are totally ignored. That problem limits the printer's practical use to an office-type environment, and indeed that appears to be its intended use.

Of the ASCII control codes, the printer responds to CR (carriage return) and LF (linefeed), BS (backspace), HT (tab), DC1 (left margin set), DC2 (tab set), DC3 (right margin set), DC4 (tab clear), NAK (which prints 1/4), SYN (which prints 1/2), CAN

(margin release), and EM (which turns the automatic underscore on and off).

The carriage return/linefeed arrangement is standard, and works much like most other printers: the machine looks for a carriage return followed by a linefeed. If it doesn't get a linefeed, it will put one in. If it does, the printer will assume that it is the correct linefeed and not insert another one. That will work fine with most computers, the exception being those from Radio Shack. Every Radio Shack printer always provides its own linefeed after a carriage return. Thus, since Radio Shack software is configured to work with the Radio Shack printers, if you use a Radio Shack word-processing program such as *Scriptit*, and specify double spacing, the printer will produce only single-spaced copy. To get double-spaced copy, triple-spacing must be specified, and so on. Incidentally, that problem is not just limited to the *TP-1*, but will happen when you use almost any non-Radio-Shack printer with Radio Shack software.

The printer can use either multi-strike fabric or single-strike carbon ribbon cartridges. Both ribbons and printwheels are easily removed and installed because the operating controls are oversize and conveniently positioned. At each turn on, and whenever the cover is lifted, the machine runs a diagnostic procedure that causes the printhead to travel back and forth. If, for some reason, the cover is lifted during

a print, the printer interrupts the computer, the diagnostic runs, and the printhead relocates itself at its last print position so it can pick up correctly when the computer resumes output.

In operation, the printer runs exceptionally well. The mechanism is a little on the noisy side, but the print quality is superb. The characters print on a precise line, and equally well at either side of the paper. While the printer isn't the fastest one around, it's not all that slow either. Besides, anything that will work much faster also is going to cost significantly more.

The only real problem with the machine is the operator's manual. Saying that it leaves a lot to be desired is being kind. For example, you'll need a really good understanding of BASIC to be able to set the margins under program control as there is no description that makes sense. Specifically, the manual says "The printer carriage must be positioned to the desired margin set point...." —there's no way that can be done, either electrically or manually. A print statement filled with spaces directly in front of the margin-set ASCII code must be used to set the margins. The instructions for setting the tab are just as bad. Also, there is no list of how each ASCII code affects the machine. Finally, the ASCII control codes are given only in hex, not decimal, yet most software requires decimal input

# IF YOU'RE NOT ON OUR MAILING LIST . . . ... LOOK WHAT YOU'RE MISSING!

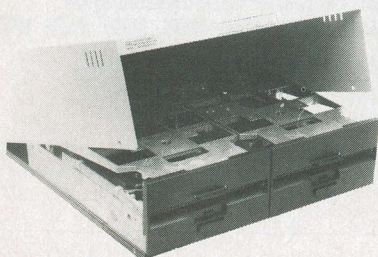
## BUY DRIVES AND CABINET TOGETHER AND \$AVE!

DUAL 8" SIEMANS FDD1008, DUAL 8" CABINET,  
POWER SUPPLY AND INTERNAL POWER CABLING.  
IF BOUGHT SEPARATELY: \$910.00

# \$695.00

RLPDBIIISIE Include \$30.00  
for shipping

- Positive Pressure Filter Cooling
- Power Supply: 4A @ +5V, 3A @ +24V  
1A @ -5V
- Each output is individually fused
- Hinged top for easy access
- Heavy non-flex .090 aluminum base
- Modular power connectors



### ENVIRONMENT MONITOR PANEL

Temperature and voltage monitor with visual and audible alarm for overtemp condition. Direct Digital Readout of internal temperature in C on standard DVM.

RLIIFDE002 CABINET ONLY . . . . . \$295.00  
RLPDBIIISIE 2-Drives, Cabinet & disk environment monitor . . . \$775.00  
RLIIFDE002EM Cabinet only with disk environment monitor . . . \$375.00

### SIEMANS FDD100-8 TRUCKLOAD PURCHASE

WE'VE CAPTURED THE 8" FLOPPY DRIVE  
MARKET WITH A HUGE FACTORY DIRECT  
PURCHASE!!

WOW!!



FDD1008  
8" FLOPPY

WOW!!  
RLSIEFDD100-8 SINGLE SIDED, DOUBLE DENSITY  
SHUGART 801R COMPATIBLE  
90 DAY WARRANTY  
\$275.00 - 1  
\$259.00 - 2 - 9  
\$225.00 - 10 +  
Include \$7.00 per drive for shipping



**PRIORITY ONE ELECTRONICS®**

9161 Deering Ave., Chatsworth, CA 91311



**ORDER TOLL FREE (800) 423-5922 - CA, AK, HI CALL (213) 709-5464**

Terms U.S. VISA MC BAC Check Money Order U.S. Funds Only CA residents add 6 1/2% Sales Tax MINIMUM PREPAID ORDER \$15.00 Include MINIMUM SHIPPING & HANDLING of \$3.00 for the first 3 lbs. plus 40¢ for each additional pound. Orders over 50 lbs. sent freight collect. Just in case, please include your phone number. Prices subject to change without notice. We will do our best to maintain prices through November, 1982. Credit Card orders will be charged appropriate freight. If you haven't received your Fall '82 Engineering Selection Guide, send \$1.00 for your copy today. Sale prices are for prepaid orders only.



# Moving up to Philips just moved down in price.

## Make your move today. To top quality professional test equipment—Philips.

All over the world Philips produces the test that more people trust. That's because the same superior engineering and ergonomic principles that go into our over \$6000 digital storage scope can be found in our 15MHz scope and our super smart counters.

We put more into every scope and counter. More wanted features. More precision. More rock-solid

quality. So you get more. And now for a whole lot less!

Check our specs. Check our new low prices. Then check yourself into the world of professional testing—with Philips.

### Philips PM3207 Dual Trace Scope

- 15MHz/Dual Trace • Auto triggering • Bright, clear CRT • 5mV sensitivity • Same sensitivity X and Y • B-Invert • Triggering from A or B • TV triggering

### Super Smart Counters with seven digit high/low frequency readouts in one second!

- Microprocessor control • 120MHz or 1GHz frequency range • Auto triggering on all waveforms • High-contrast liquid crystal display • High stability TCXO oscillator: 10<sup>-7</sup>/mth • Line and battery options • 15mV RMS sensitivity • Self-test and self-diagnosis routine • Easy operation through built-in intelligence

PM6667  
120MHz  
High Resolution  
Counter  
**\$430**

PM3207  
15MHz Dual Trace  
Oscilloscope  
**\$725**

PM6668  
1GHz  
High Resolution  
Counter  
**\$595**

# From Philips, of course.



**Test & Measuring  
Instruments**

**ORDER TOLL-FREE  
800-631-7172**  
Call now or mail coupon  
for further information

Send me spec sheets on the following:

- ☐ PM3207 15MHz/Dual Trace Oscilloscope  
☐ PM6667 120MHz High Resolution Counter  
☐ PM6668 1GHz High Resolution Counter

NAME: \_\_\_\_\_

STREET: \_\_\_\_\_

CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP: \_\_\_\_\_

RE-12-2

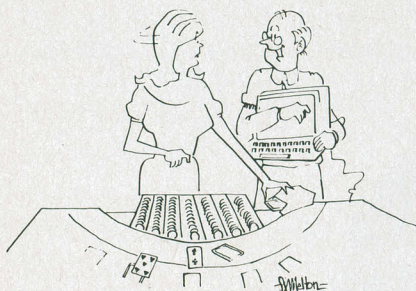
## PHILIPS

For more information call 800-631-7172, except Hawaii, Alaska and New Jersey. In New Jersey call collect (201) 529-3800, or contact Philips Test & Measuring Instruments, Inc., 85 McKee Drive, Mahwah, NJ 07430. In Canada: 2375 Steeles Ave. W., Unit 126, Downsview, Ont., Can. M3J 3A8. (416) 665-8470.



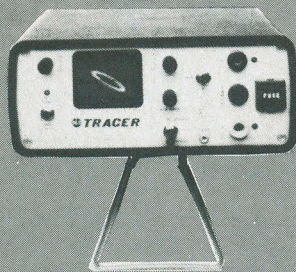
when imbedding control codes. Even BASIC sends the CHR\$ function in decimal. If you get the machine, be sure to dig up a standard ASCII code chart somewhere.

Except for that operator's manual, however, the TP-1 does a notably excellent job for the money. It has none of the bells and whistles of the super daisy-wheel printers, but it also doesn't cost anywhere near as much. If you're looking for something that will turn out a good-looking document and stand up to the rough handling of a typical office, be sure to look at this unit. And, if they ever come out with a retrofit to provide the symbols used in BASIC listings, this will be a dynamite all-purpose printer. **R-E**



"Hit me, Honey, I've got a system."

## Non-Linear Systems Model TR-1 Signature Analyzer



CIRCLE 104 ON FREE INFORMATION CARD

NLS	TR-1
OVERALL PRICE	
EASE OF USE	
INSTRUCTION MANUAL	
PRICE/VALUE	
	1 2 3 4 5 6 7 8 9 10
	Poor Fair Good Excellent

HAVE YOU EVER WISHED THAT YOU HAD an in-circuit tester that could be used to identify instantly faulty transistors, di-

odes, capacitors, inductors, and the like? Well, new from Non-Linear Systems, Inc. (533 Stevens Ave., Solana, CA 92075) is a compact analyzer called the model TR-1; that handy little unit can do just that.

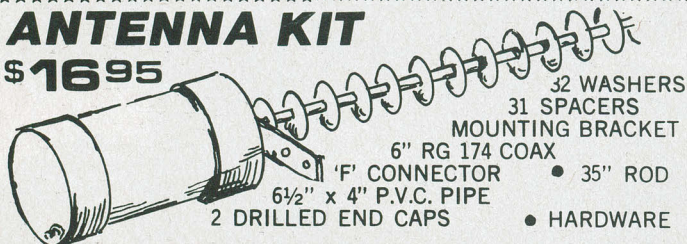
The device works on the principle that if a known signal is fed to a component, the resulting waveform, called a signature, can be used to diagnose a fault in that component. For a good transistor junction, the signature is a slanting line ending in a sharp hook. If, however, the corner of the hook isn't sharp, but rounded or looped, leakage is indicated. Good diodes, on the other hand may show a small loop on the hook if they are slow-recovery types; fast-recovery types, however, must show a sharp hook like a transistor's. Good inductors and capacitors are shown as a loop. For capacitors, that loop slants to the right; for inductors it slants to the left. For all components, a straight line (no loop or hooking) indicates a short or open—shorts show up as a vertical line; opens a slanting line. After a little practice, good and bad components can be spotted almost instantly by analyzing the displayed signature.

The analyzer has two input channels; one is labeled A and the other B. Either one can be selected using a front-panel switch. That two-channel capability is useful for many applications including checking such things as stereo amplifiers.

## 2300 MHz VARIABLE DOWNCONVERTER

### ANTENNA KIT

\$16.95



### POWER SUPPLY KIT

\$16.95



POWER TRANSFORMER  
COURSE TUNE POT.  
FINE TUNE POT.  
3 'F' CONNECTORS  
RESISTORS & CAPS  
LED WITH HOLDER  
TERMINAL STRIP

P.C. BOARD  
RF CHOKE  
KNOB  
WIRE  
2 SWITCHES  
4 DIODES  
LM 317 REG.

WOOD GRAIN CABINET WITH SILK  
SCREENED front and back \$10.95 Extra  
BUILT POWER SUPPLY.....\$34.95

Complete  
Down Converter  
System  
INCLUDES  
ANTENNA KIT  
POWER SUPPLY KIT  
CONVERTER KIT  
**SPECIAL \$49.95**

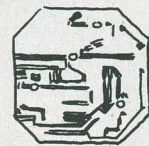
**QUANTITY DISCOUNTS**  
Any Price in Adv.  
10 pcs. .... 12% off  
25 pcs. .... 18% off  
50 pcs. .... 25% off  
100 pcs. .... 30% off  
1000 pcs. .... 35% off  
No Mixing for  
Quantity Discount

### PARTS

Converter P.C. Board  
Plated through holes for stability.....\$4.95  
Power Supply  
P.C. Board .....2.95  
MRF 901 .....2.00  
NEO2135 .....4.95  
2835 Diodes ..... .95  
.001 Chip  
Caps. .... 10/3.95  
Choke Set of 4.....1.95  
LM 317 Regulator 1.25  
'F' Connectors  
Chassis ..... .50  
Wall Transformer  
12 VAC 700 MA....4.95  
'U' Bolt ..... .95  
BALUN  
75 to 300 ohm.....1.95  
BALUN  
for rabbit ears....2.95  
\*RG 59/U COAX  
WITH CONNECTORS  
FACTORY MADE  
100 Ft. ....\$17.50  
50 Ft. .... 9.50  
25 Ft. .... 5.75  
3 Ft. .... 2.50

### CONVERTER KIT

\$16.95



P.C. BOARD PRE-DRILLED  
SOLDER PLATED WITH  
PLATED THROUGH HOLES  
FOR A MORE STABLE PICTURE.  
**NEW!!**  
... 2137 HOT TRANS...

3 MRF 901 TRANSISTOR  
2 HP 2835 Diodes  
6 .001 Chip Caps.  
9 Resistors  
4 Prewound chokes  
1 Electrolytic Cap.  
1 Pre Made Probe



**\*WIRED P.C. BOARD TESTED, READY TO CONNECT TO CAN WITH PROBE & CABLE CONNECTOR ATTACHED.**  
**\$24.95**

We will tune converter board for \$12.50  
trouble shoot  
add .....7.50  
trouble shoot  
power supply..\$12.50  
plus any parts needed.

We will accept telephone orders for Visa & Mastercard  
No C.O.D. Orders

**To Order Call 800-428-3500 317-291-7262**  
Complete Kit Weighs 10 pounds. Please add Sufficient Postage  
**6254 La Pas Trail**  
**Indianapolis, Indiana 46268**

# ELECTRONIC RAINBOW



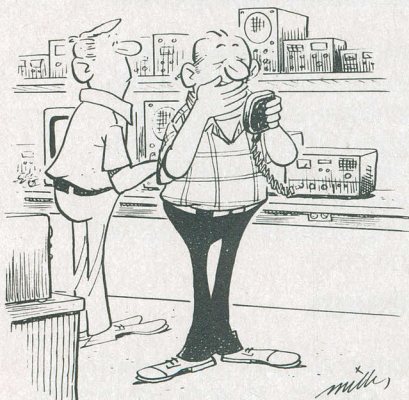
For instance, a component in the good channel can be compared to the same component in the bad one to locate the source of the problem. Two sets of color-coded test leads are supplied with the unit.

A third position on the selector switch is labelled A/B. When the selector switch is in that position, the input channels are automatically switched at a rate set by the A/B RATE control located on the front panel; that rate can be varied from 0.25 to 0.5 seconds. Synchronization of the patterns is completely automatic; no adjustments are needed. LED indicators are used to show you which channel is being displayed.

The test signal used by the unit is a 2-kHz sine wave. Either a 2-volt or 50-volt amplitude (P-P) can be switch selected. The resulting waveform is displayed on the analyzer's small (1-inch) CRT. The very bright blue-white trace can be centered using the positioning controls that are located conveniently on either side of the CRT. The graticule is calibrated to give approximate resistance readings. Resistances from 0 to 500 ohms can be read in the LO range; resistances from 500 ohms to 500 kilohms can be read in the HI range.

There are many applications where this device should prove to be useful. Among them are checking large numbers of identical parts to weed out the bad ones or cross-checking between a known good part and one suspected to be bad. It could also be useful for testing digital devices where many identical circuits are used. With use, you're sure to find many more applications where this device can save you a considerable amount of troubleshooting time and effort.

In using the model TR-1 we found drift to be negligible and the displayed trace to be rock steady. All-in-all this handy device worked exactly as claimed. Two models of the analyzer are available. One is a line-operated version for bench use and lists for \$795. The other is battery-operated for portable and field use; it lists for \$945 with battery charger. **R-E**



"He keeps reminding me he fixed his radio in 60 seconds flat. Now watch this: Helloph, Batphm, do youth reef me?"

# Simplify your life.

## Full Function Digital Multimeter

- TRMS ACV and ACA
- 0.25% Basic Accuracy

## Built-in Thermometer

- °C and °F Models
- Type K T/C Based



## A practical approach to TRMS.

Keithley's 132 with TRMS lets you make precision measurements on non-sinusoidal signals that averaging can't handle, like SCR waveforms. And because the 132 is AC coupled, the DC signal component is blocked. So you can measure AC signals and DC signals separately, like the AC ripple on a DC supply voltage. And all the other capabilities you expect are here, like DCV from 200mV to 1000V, with 0.25% accuracy. And current ranges from 2mA to 2A, resistance ranges up to 20MΩ including diode test. Plus input resistance of 10MΩ to avoid circuit loading.

## A common-sense approach to temperature measurement.

With Keithley's 132, you can make accurate temperature measurements without a separate thermometer or converter. This type K thermocouple based instrument gives you a wide range from -20°C to 1370°C (0°F to 2000°F on Fahrenheit model), all with 1° resolution. The 132 also features a standard TC connector with cold junction compensation, and a full line of probes to match any application.

## See for yourself.

A full line of multimeter accessories expands these capabilities even further. For quality, common sense utility, durability, ease of use and affordability, get your hands on a Keithley handheld DMM. No matter what your situation, a Keithley DMM will simplify your tasks. Contact your local Keithley distributor for a demonstration.

# KEITHLEY

Keithley Instruments, Inc.

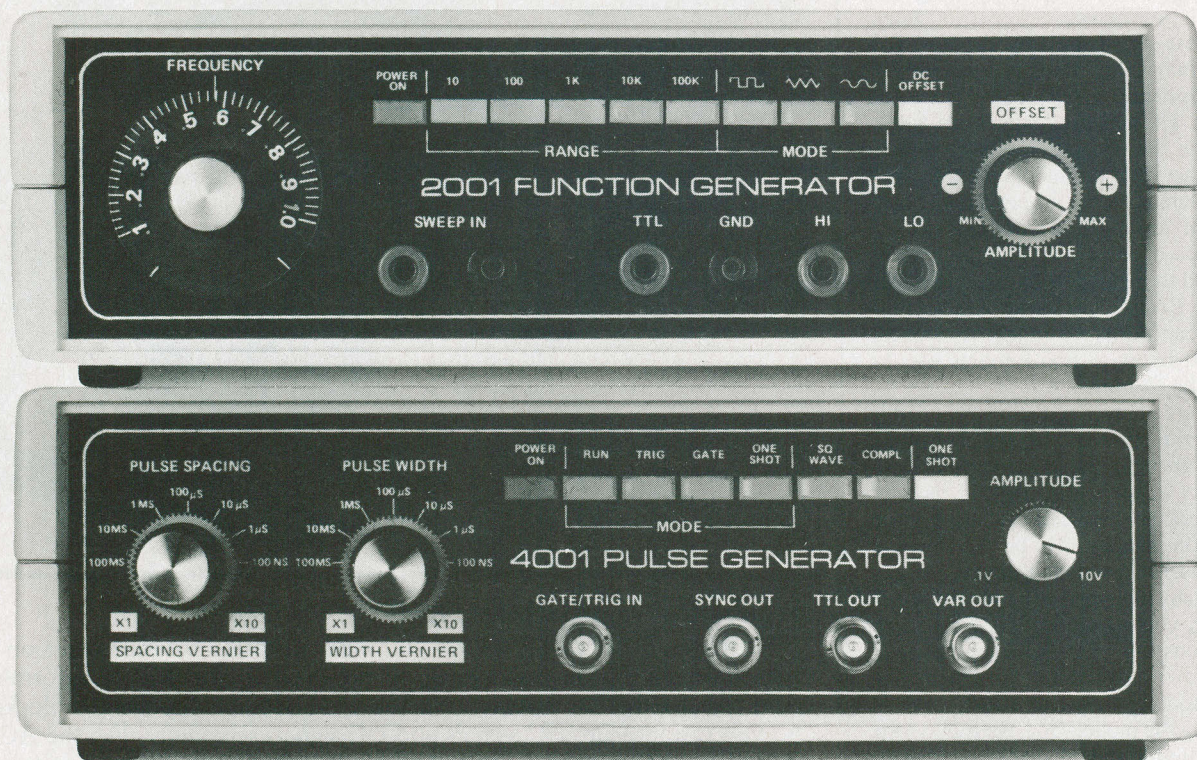
28775 Aurora Road/Cleveland, Ohio 44139-9990/(216) 248-0400

CIRCLE 19 ON FREE INFORMATION CARD



# Function. Pulse. And save.

Global Specialties sets a new value standard. Twice.



## Model 2001 Sweepable Function Generator. \$200.00\*

Get the waveforms you need — 1 Hz to .1 MHz in five overlapping ranges: stable, low-distortion sine waves, fast rise/fall-time square waves, high linearity triangle waves — even a separate TTL square wave output. Plus high- and low-level main outputs.

An applied DC Voltage at the Sweep input can shift the 2001's frequency; or sweep up to 100:1 with an AC signal.

A pushbutton activates the DC Offset control, which shifts the output waveform up or down on command.

You'd expect to pay a lot more for all the 2001 can do!

## Model 4001 Ultravariable Pulse Generator.™ \$249.95\*

Here's a precision digital pulse generator with fast rise and fall times covering 0.5 Hz to 5 MHz in 5 overlapping ranges. With pulse width and pulse spacing each independently variable from 100 nsec to 1 sec for an amazing  $10^7:1$  duty cycle range.

You'll find the 4001 delivers the pulse modes you need: Continuous, One-Shot, Triggered, Gated, Square Wave, even a Complement mode. The Trigger/Gate input, 50 Ohm variable output, TTL-level output and Sync output connectors are BNCs.

The 4001. Nothing does as much as well for anywhere near the price.

Smarter tools for testing and design.

**GLOBAL  
SPECIALTIES  
CORPORATION**

Call toll-free for details  
**1-800-243-6077**  
During business hours

70 Fulton Terr. New Haven, CT 06509 (203) 624-3103, TWX 710-465-1227  
OTHER OFFICES: San Francisco (415) 648-0611, TWX 910-372-7992  
Europe: Phone Saffron-Walden 0799-21682, TLX 817477  
Canada: Len Finkler Ltd., Downsview, Ontario

\*Suggested U.S. resale. Prices, specifications subject to change without notice. © Copyright 1980 Global Specialties Corporation.

CIRCLE 10 ON FREE INFORMATION CARD



# BUILD THIS AUTOMATIC

## COMMERCIAL EDITOR

*Are commercials ruining your pleasure when you watch your favorite black-and-white classics on TV? Build this automatic commercial editor and make commercial-free tapes.*



## FOR YOUR VCR

GARY McCLELLAN

ATTENTION, ALL FANS OF BLACK-AND-white movies! If you like to tape those late-night classics for viewing at a more reasonable hour, you'll love this gadget. It detects color commercials, and stops your VCR (Video Cassette Recorder) while they are running. Then, when the commercials are over and the film begins again, the VCR restarts and continues to record. As a result, all the commercials are automatically edited out of the movie, and you can enjoy it without breaks.

Using the device is simplicity itself. You just connect two cables from it to the recorder's VIDEO OUT and PAUSE jacks. Then you turn it on, and start the recorder. The rest is automatic.

Besides removing commercials from black-and-white movies, this commercial editor offers several fringe benefits. For example, by eliminating commercials, the recorder uses less tape. That means that shorter (and less expensive) tapes can be used to record longer programs. (In my area, a one-hour tape will record almost 1½ hours of movies!) Still other features are a five-minute timeout, and a jack for your remote pause control.

The five-minute timeout feature restarts the recorder if the commercials run over five minutes at a time. That feature is included because some recorder manufacturers recommend that their machines be left in the PAUSE mode for no

more than five minutes. Longer than that can damage the tape, or cause excessive head wear, so the timeout feature protects both your tape and VCR. And, although the editor uses the PAUSE jack on the VCR, you can still use your remote PAUSE control as the editor contains its own jack.

You can build your own commercial editor in just a few evenings. Only four IC's are used, and there are only two easy calibration adjustments to be made. The only test equipment you need is an analog VOM and an RF signal-generator. (Don't be too concerned if you don't have the signal generator—there are ways around that, as you'll see.)

### How it works

The automatic commercial editor works by detecting the presence or absence of the *color burst* signal, which accompanies all color broadcasting, but which is not transmitted (usually) when the material is in black-and-white. When that signal appears, a relay in the editor closes and switches the recorder to the PAUSE mode. When the color commercials are over, the color-burst signal disappears, and the relay opens. That switches the VCR to RUN, and recording resumes. When the next commercial appears, the cycle repeats all over again.

Note that the program being recorded must be black-and-white for the editor to

work (otherwise the color-burst signal will be present at all times). If the film is in color, the first five minutes of program or commercials will not be recorded. After that time, because of the timeout feature, both commercials and program will be recorded.

Some readers, no doubt, are wondering whether this editor can be made to work with color programs. The answer is that it is not likely. The reason, we found—after extensive research—is that there is not enough difference between color commercials and color programs, which makes detecting color commercials very hard to do. So forget about an editor for color-program commercials...at least for now.

Now let's take a look at the inside of the editor. Refer first to Fig. 1. There are three main circuit-blocks: an AGC-controlled amplifier, a comparator, and a timer. We'll discuss them one at a time.

The AGC-controlled amplifier comes first. The signal from the recorder's VIDEO OUT jack is supplied to the input of the editor. That video signal consists of horizontal sync, vertical sync, video, and a color-burst signal. The only portion that we are interested in is the color-burst, which is really a few cycles—a burst—of a 3.579545-MHz signal. That signal tells the TV receiver that it is receiving a color transmission, and determines what the



colors are, and how bright they are. To use it, we must amplify the color burst and filter out the rest.

Bandpass filter BPF1 separates the 3.579545-MHz (from here we'll call it 3.58 MHz for short) signal from the rest of the video, and that signal is amplified by IC1. The output from IC1 drives another bandpass filter, BPF2, which peaks the 3.58-MHz signal farther. Finally, the output from that filter is detected by D1 and converted to pulsating DC. The DC biases transistor Q1, which serves as an automatic gain control (AGC). The AGC-voltage controls the gain of IC1 via resistors R4 and R1 and, as a result, the output from D1 is at a constant amplitude whenever a color signal is present.

In our application, however, the color-burst signal itself is not used. Instead, the voltage drop across R4 is detected, which brings us to the second part of the circuit, the comparator.

The comparator circuit used here is rather unusual. To prevent false triggering, several circuit twists have been added. Resistors R6 and R7 provide a 0.26 volt hysteresis, and resistor R5 and capacitor C11 are used to introduce a short time-delay. The result of those additions to the circuit is to prevent noise—which can come from the video—from falsely triggering the device.

A color-burst signal applied to the input of the editor causes a voltage drop across resistor R4. When that voltage exceeds 0.26 volt, and lasts for at least 100 ms, comparator IC2 will be triggered, and its output will go from high to low. It will stay low for at least 100 ms after the color burst disappears, and that brings us to the third circuit block.

The last bit of circuitry is a five-minute timer, built around IC3. Whenever the output of IC2 goes low, both IC3 and the relay receive power. The relay closes immediately and, if the output of IC2 does not go high within 5 minutes, IC3 times out, removing power from the relay. The relay contacts, of course, control the VCR's PAUSE function.

Now that you have a basic understanding of how the project works, let's look at Fig. 2, the schematic diagram.

The AGC-controlled amplifier is at the top of the schematic. The video signal is input through C1. Coil L1, with capacitors C2 and C3, is peaked for the 3.58-MHz color-burst signal. The two capacitors also provide impedance matching to IC1. That IC is a differential input/output IF amplifier. It amplifies the signal by up to 60 dB, and its output appears across C6 and L2. That network is also tuned to 3.58 MHz, and provides greater selectivity. The amplified signal is detected by D1, and the color burst appears across R2 and C8. The DC component of the burst biases Q1, which draws current through R4. Capacitor C9 is included to prevent Q1 from amplifying the AC component of the color-burst signal so only a DC signal

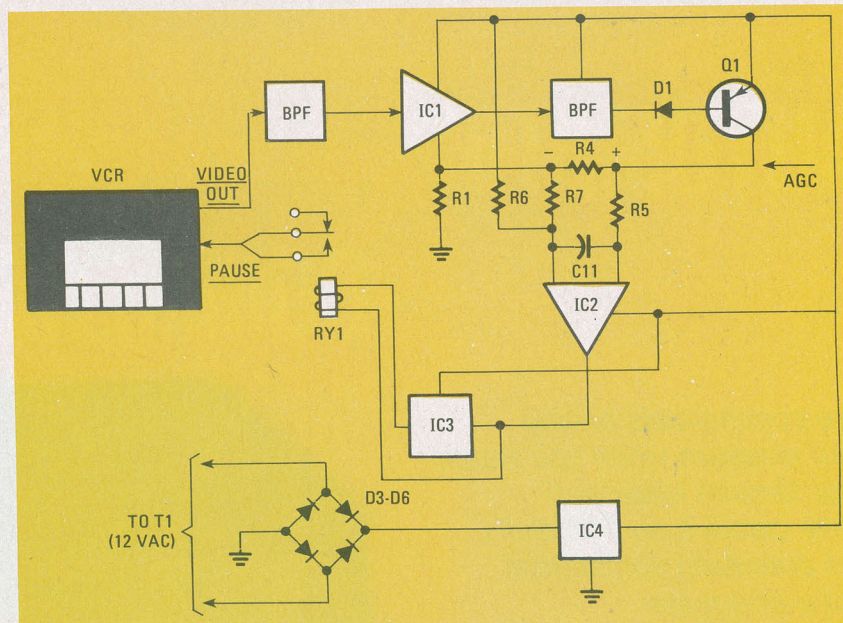


FIG. 1—BLOCK DIAGRAM OF COMMERCIAL EDITOR shows three principal sections: AGC-controlled amplifier, comparator, and timer.

is produced by Q1. From R4, that signal goes to IC1, where it controls the gain of the amplifier. In addition, IC1 also provides a 5-volt DC bias for the comparator; that 5-volt DC bias appears on pin 5 of IC1 and is necessary for the comparator to work properly.

Comparator IC2 monitors the voltage drop across R4. Resistors R6 and R7 form a voltage divider, biasing pin 2 of IC2 0.26-volt higher than the other input (pin 3). Thus, the voltage across R4 must equal or exceed the 0.26-volt hysteresis to trigger IC2. That extra circuitry was added to improve noise immunity.

With no color present, the output of IC2 will be high. When a color burst is present, though, there will be a voltage drop across R4. Typically, that will be 0.3 to 1.0 volt, depending upon the color intensity. When the voltage drop exceeds 0.26 volt, the comparator's output will go low. That, in turn, will trigger the timer circuitry.

In addition, the C11/R5 time-delay circuit provides a short time-delay (about 100 ms) before the comparator is triggered. That prevents noise spikes from triggering the comparator.

The output of the comparator drives a five-minute-timer circuit. Whenever pin 7 of IC2 goes low, a ground is provided for the IC3 circuitry, and that, in effect, applies power to the timer. Capacitor C14 and resistor R9 provide a trigger pulse for the timer, which causes relay RY1 to close, and C13 to charge slowly through R8. After about five minutes, the capacitor is sufficiently charged to trigger IC3, which opens RY1. Of course if the commercials last less than five minutes, the output of IC2 goes high sooner. In that case, the timer starts all over the next time it receives power. Note that the relay contacts are connected to the PAUSE jack on the recorder.

Finally, there's a simple 12-volt power supply. A wall-plug transformer supplies about 14-volts AC to D3-D6; from there the voltage is filtered by C15. It is regulated to 12-volts DC by IC4.

#### PARTS LIST—EDITOR

**All resistors 1/4-watt, 5% unless otherwise specified**

R1-R3—10,000 ohms  
R4—1000 ohms  
R5, R6—1 megohm  
R7—48,000 ohms  
R8—10 megohms  
R9—100,000 ohms

#### Capacitors

C1—10 pF, ceramic disc  
C2—220 pF, ceramic disc  
C3—470 pF, ceramic disc  
C4, C5, C7, C8, C14, C17, C18—0.01  $\mu$ F, ceramic disc  
C6—150 pF  
C9, C10, C12—0.1  $\mu$ F, ceramic disc  
C11—0.1  $\mu$ F, Mylar  
C13—22  $\mu$ F, 16 volts, low-leakage electrolytic  
C15—470  $\mu$ F, 25 volts, electrolytic  
C16—10  $\mu$ F, 16 volts, electrolytic

#### Semiconductors

IC1—MC1350 IF amplifier  
IC2—LM311 comparator  
IC3—555 timer  
IC4—78L12 12-volt regulator  
Q1—2N3906 or equivalent  
D1—1N6263 Schottky signal-diode or 1N60 germanium diode  
D2-D6—1N4002  
RY1—12-volt SPDT relay, 400-ohm coil (Mouser 43BC001 or equivalent)  
L1, L2—10  $\mu$ H adjustable shielded coil (J.W. Miller 9052 or equivalent)  
P1—RCA phono plug  
P2—subminiature phone plug  
J1—subminiature phone jack  
S1—SPST toggle switch  
T1—12 VAC, 250 mA, wall-plug transformer  
**Miscellaneous:** PC board, IC sockets, RG-174 coaxial cable, case, wire, solder, etc.



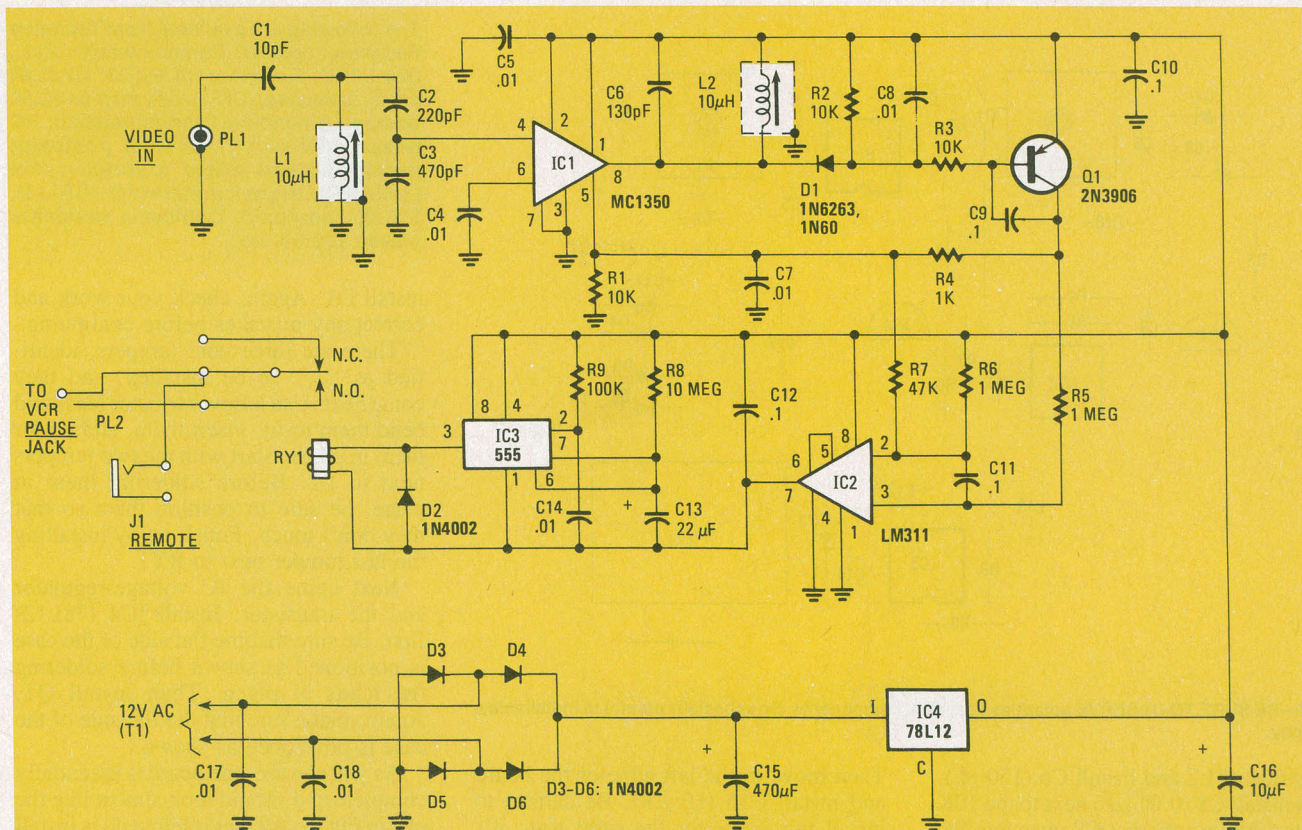


FIG. 2—AGC-CONTROLLED AMPLIFIER is preceded by two bandpass filters that isolate 3.579545-MHz color-burst signal.

### Assembly

The commercial editor is intended to be built on a small PC board. In fact, you *must* use a PC board. If you don't, the AGC-controlled amplifier will probably oscillate, making it impossible to adjust the unit.

Figure 3 shows the foil pattern for the single-sided PC board, and Fig. 4 the parts-placement diagram. Start by positioning the board foil-side down so it faces the same way as the board shown in Fig. 4.

Start assembly with the IC sockets. Install 8-pin sockets at IC1, IC2, and IC3 as shown, and carefully solder them in place.

The coils and the relay are installed next. Install a coil at L1, and push it flush with the board; then solder it in place. Similarly, install L2. Finish up by installing relay RY1 in the appropriate position. Be sure to push it flush with the board before soldering.

The resistors are installed next. Start by installing R1 (10K) next to L2. Then install another 10K resistor at R2, and still another 10K resistor at R3 as shown. Move over to the IC2 socket and install R4 (1K) near it. (Be careful not to put it in the R5 position!) Then install R5 (1 megohm) between R4 and the IC2 socket. Move to the right of the IC2 socket and install R7 (47K). Again, make sure it's in the right place. After that, install R6 (1 megohm) next to R7. Move down to the

IC3 socket for the remaining resistors. Install R8 (10 megohms) just to the left of the socket. Then move down and install R9 (100K). That finishes up the resistors. Check your work carefully, and correct any mistakes you may find.

Install the capacitors next. Start by mounting C1 (10 pF) next to L1. Be sure to push the part flush with the board be-

fore soldering its leads in place. Then install C2 (220 pF) next to L1 in the same manner. Similarly, install C5 (0.01  $\mu$ F) as shown. After that, install C3 (470 pF) between L1 and the IC1 socket. Move to the left of the IC1 socket and install 0.01  $\mu$ F capacitors at C4 and C7.

Continue by installing C10 (0.1- $\mu$ F ceramic disc) next to L2. Move to the

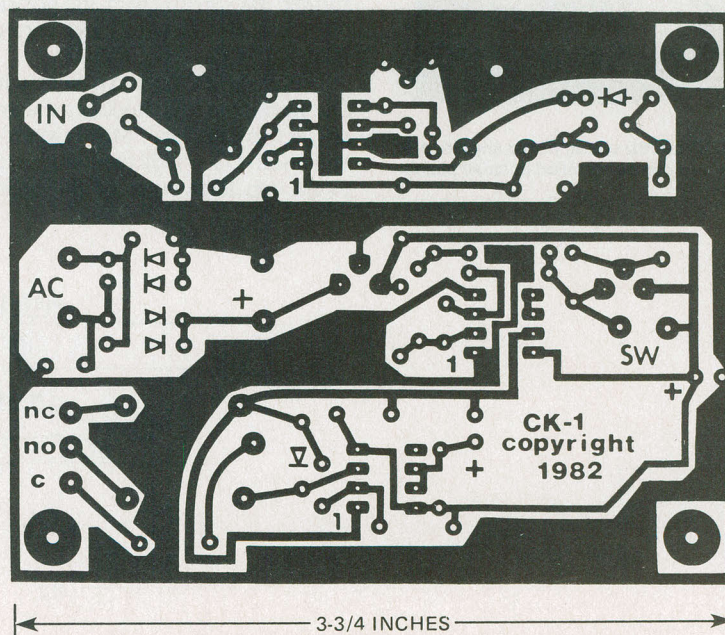


FIG. 3—FULL-SIZE foil pattern for single-sided editor PC board.



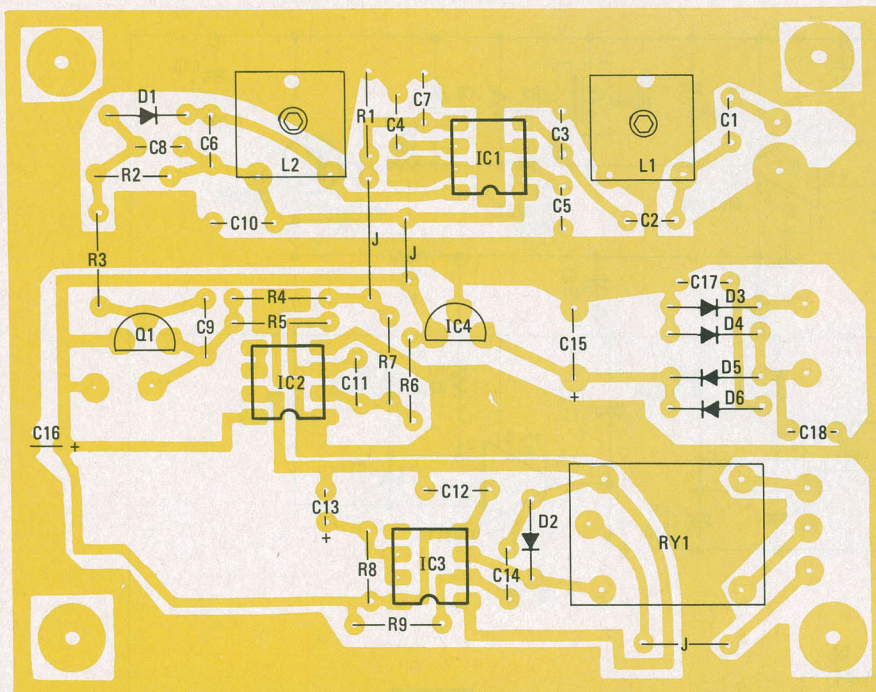


FIG. 4—BE SURE TO OBSERVE polarities of critical components. Be especially careful to install relay correctly.

other side of L2 and install C6 (150 pF). Then install C8 (0.01  $\mu$ F) next to the 10K resistor. Make sure that C8 goes into the correct holes. After that, install C9 (0.1- $\mu$ F ceramic disc) between the resistors.

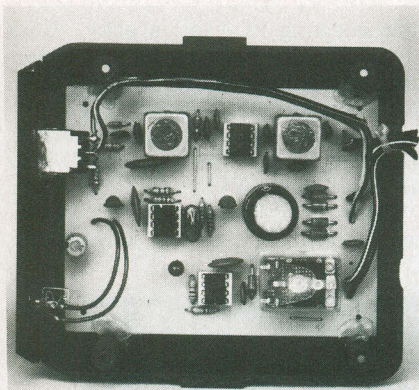


FIG. 5—COMPLETED circuit board should look like this. Board can be installed in small plastic clock-case.

Then move to the left edge of the board and install C16 (10  $\mu$ F). Be careful to install this capacitor the right way; it's polarized. Similarly, install C13 (22  $\mu$ F) next to the 10-megohm resistor. Then move up and install C11 (0.1- $\mu$ F Mylar) between the IC2 socket and the 47K resistor. Continue by installing C12 (0.1  $\mu$ F) above the IC3 socket and, after that, install C14 (0.01  $\mu$ F) to the right of the IC3 socket. Move to the right center of the board and install C15 (470  $\mu$ F) as shown. Be sure that this polarized part is inserted properly, then push it flush with the board and solder the leads in place. Finish up by installing C17 and C18 (0.01  $\mu$ F). Carefully check your work before going any further. Be sure to check the polarities of the three electrolytics, and correct any mistakes before continuing.

Install the diodes next. Start with D3-D6. Install the four diodes as shown, then solder them in place. Move over to RY1, and install D2 as indicated. Finally, move to the top left corner of the board and

The following are available from Technico Services, 1920 W. Commonwealth Ave., Box 20HC, Fullerton, CA 92633: kit of all parts, *less case*, (CK-2), \$54.00 plus \$3.50 postage & handling (nonrefundable); PC board only (CK-1), \$10.00, postpaid; assembled and tested calibration tool (3.58-MHz signal generator) (CAL-3), \$10.00, postpaid. California residents please add 6% tax.

install D1. Again, check your work and correct any mistakes before continuing.

There are three wire jumpers, identified as "J," to be installed, and they come next. Use leftover resistor leads and bend them to fit, insert them, and solder them in place. Start with the two jumpers next to L2. Before soldering them in place, be sure to position them so that they don't touch. Finish up by installing the last jumper next to RY1.

Next come the IC voltage-regulator and the transistor. Install IC4 (78L12) first. Be sure that the flat side of the case is positioned as shown before soldering the leads in place. Then install Q1. Again, make sure that the flat side of the case is positioned as shown.

As you can see, the board is essentially complete and should look almost like the one in Fig. 5. All that is left to do is install the IC's and attach the cables.

Start with the IC's and install IC1 (MC1350) first. Be sure to position it properly before you plug it in. Then install IC2 (LM311) in the same manner and, finally, IC3 (NE555). Be sure to check the IC's for proper installation before continuing.

Finish up by installing the cables (refer to Fig. 6). Start with the video-input cable. Cut a two-foot length of RG-174 coaxial cable, then strip and tin each end. Attach PL1 (RCA phono plug) to one end. Then connect the other end to the board. Note that the shield goes to the heavier ground foil on the board.

After that, connect the transformer leads. Measure about four inches from the end of the cable that is attached to T1 and cut *just one* of the wires at this point. Connect switch S1 at that point. Solder the free ends of the T1 cable to the appropriate pads on the circuit board.

Next, cut a two-foot piece of two-conductor wire (a short length of speaker wire will do). Attach PL2 (subminiature phone plug) to one end, and connect the other end of the cable to the board as shown.

Finish up the cable installation by wiring J1. Cut two two-inch lengths of hookup wire and solder them to J1 (subminiature phone jack). Then connect the other ends to the pads on the board.

That completes assembly of the editor's PC board. Once you've carefully checked your work, the next step is to align the device. That will be just one of the topics we'll cover in the next part of this article.

R-E

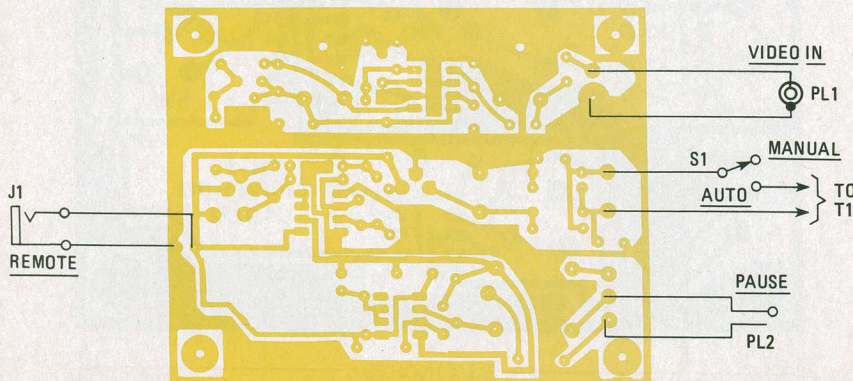
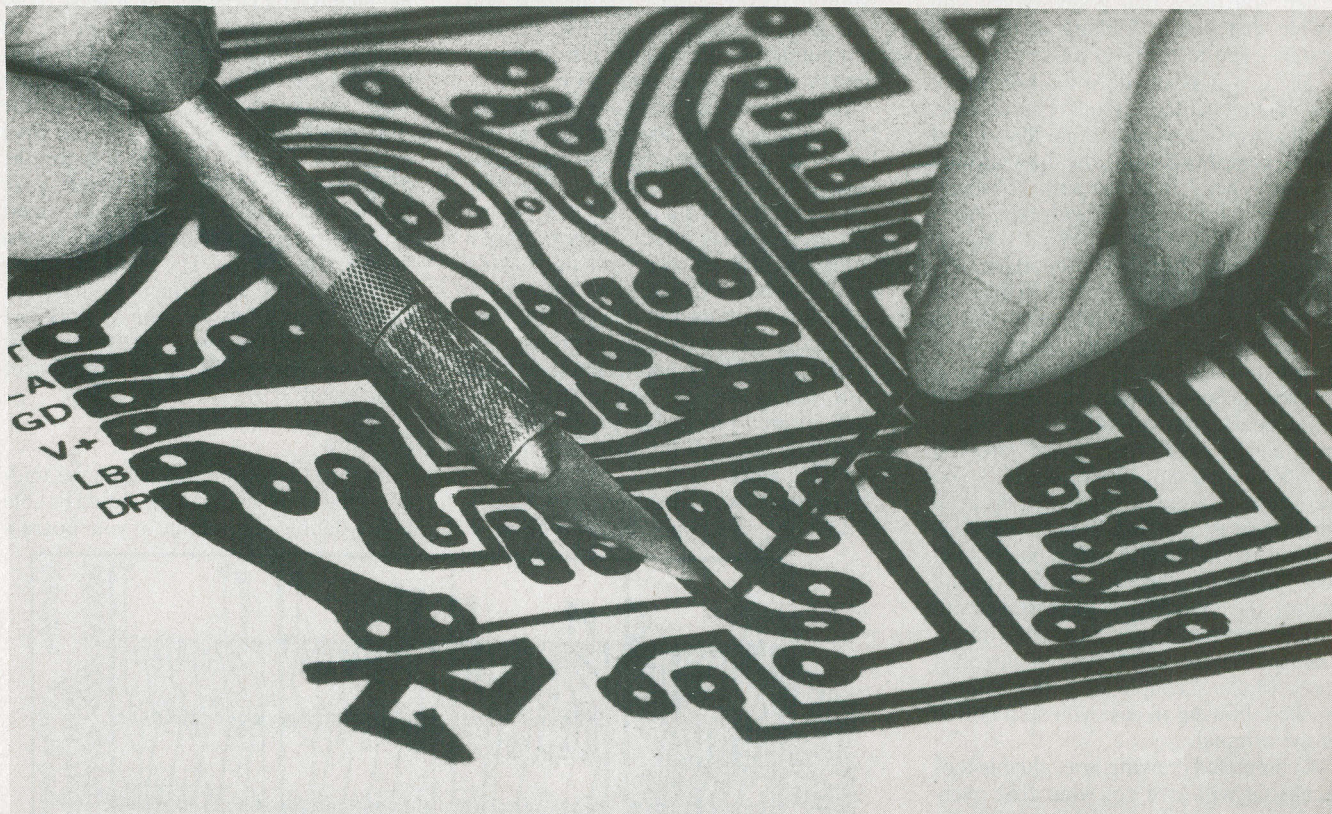


FIG. 6—OFF-THE-BOARD connections. Use RG-174 coax for VIDEO IN cable.





ELECTRONICS HOBBYISTS HAVE NEVER had it as good as they do today. The modern home workshop can now be equipped with laboratory-grade instruments at consumer prices and can produce projects of industrial quality. It's rather astounding to consider that the decision whether to build or buy is more a function of convenience than complexity. Ever since the IC manufacturers discovered the profits to be made in the consumer market, the components needed for virtually any project are rarely more than a postage stamp away.

So why haven't we seen a tremendous increase in the number of sophisticated projects built and developed on a back-room bench? Obviously there's been a problem, but the biggest stumbling block to home construction doesn't have anything to do with design or complexity—nine times out of ten it's the printed-circuit board. A hobbyist who wouldn't think twice about designing a circuit for bouncing signals off Neptune often cringes when he considers producing printed-circuit boards. While electronics technology gets more sophisticated almost by the minute, the process of making PC boards has remained just about the same for the last thirty years. And the reason why it hasn't changed is that the process is really quite simple.

No kidding, it's really easy to do. There's been a big push among manufacturers to develop wire wrapping as some sort of technology all on its own. If you're into wirewrapping, don't bother

## ETCH YOUR OWN PC BOARDS

*There are lots of ways to make printed-circuit boards, but if the pattern is complicated, nothing beats doing it photographically.*

ROBERT GROSSBLATT

reading any farther because all I think wire wrapping is good for is baling hay. But making even the most complicated double-sided board isn't difficult—it takes time and requires attention to detail, but it's not hard. Let's take a look at the basic procedure.

Copper-clad board is coated with a light-sensitive chemical and allowed to dry. A mask is made photographically (the foil pattern) and contact-printed on the board. The light in the printing process causes a change in the chemical coating so that the unmasked areas become resistant to the developer. What happens then when the board is placed in the developer is that the chemical over the unmasked areas (the traces) remains, while the chemical over the rest of the board is removed. The result is a board ready to be dumped into the etchant. That is the basic procedure for so-called negative photore-sist; there's also a positive resist but the idea is the same. As you can see, there are several steps in the process and we'll go over them completely later on in this article. By the time we finish, however, you'll be wondering why you thought it was difficult in the first place.

### Layout

Before we explore the mysteries of board making, there's something that comes first—laying out the pattern. By the time you're ready to consider making PC boards you've probably pulled out a lot of hair in breadboarding. You've rearranged circuitry and substituted differ-



ent values to make sure everything is working exactly the way you want it. When you reach that point—when you decide that you're looking at the final design—you're ready to move on.

The first step is to draw a schematic of your breadboarded circuit. The chances are that you've already done that, but if you're anything like me the drawings are a mess. When I'm at that point, I usually have several pages filled with false starts and things that blew up. That's to say nothing about the most important sections, which I usually scribble on the back of an envelope. It's really important to stop and redraw everything. Make a clean drawing of the circuit, lay it out in a coherent fashion, assign numbers to the components, and carefully label everything on the page. Also, make sure you include the pin numbers of the IC's you are using. Use graph paper to help keep the lines straight and do as many versions as you need in order to make the drawing neat. Keep on checking your drawing against the breadboard as mistakes are easy to correct at this stage—it's much simpler to erase a line than to correct a trace. Make a couple of copies of the finished drawing in case you spill coffee on the original.

A completed drawing is a valuable tool because it will give you your first overview of your entire circuit. Don't be surprised if you wind up combining things or simplifying the design. Unused gates can be combined to eliminate whole IC's and a little reorganization can allow you to simplify complicated sections of your design. I usually wind up with several stages of "final" drawings until I get the point where any further changes are profitless. When you've reached that stage you are ready to begin the layout of the board.

At this point you have the schematic and the breadboarded circuit. **Whatever you do, don't fool around with the breadboarded circuit!** Not only will you still be checking the drawing against it, but later on, when the printed-circuit board is complete but perhaps doesn't work, you'll have something to compare it to. Remember an all-important rule of original design: the breadboarded circuit is the only one in the world that does what you designed it to do. The last step in creating a working circuit on a PC board, *the very last step*, is to pull the breadboard apart.

### Special considerations

Examine the breadboard and the drawing. Are there sections of your design that have to receive special treatment? If certain sections need shielding, or have unusual power requirements, they should be physically close together on the board. Should the circuit be broken into several boards to conserve space? Is the printed-circuit board going to provide structural strength to the finished project? Does the board have to have a particular shape be-

cause of the case? Those are the sorts of questions you have to consider when you begin to do the layout. The answers will determine the materials you use, the size and number of the boards, how compact the layout has to be, and so on.

Before you start planning the printed-circuit pattern make sure that you have all the components that go on the board. Resistors, capacitors, and other components come in different shapes and sizes—and you're doing a layout for components of a particular size. If you plan on making three boards, make sure you already have three of everything you'll need. There are few things sadder than going through the trouble to make a complicated board and then finding out that certain small electrolytics aren't available any longer. It's always best to stick with standard, readily available parts.

The best way to work out your layout is to do it on graph paper, but the choice of

paper is important. What you want is a light-blue grid measuring ten squares to the inch. Get a large pad of at least 20 by 24 inches and tell the people in the art supply store that you want it to be non-reproducible blue. That is a particular shade of blue that won't register on the film you'll use to photograph the final drawings. The pencils you use for the initial drawing should be the same shade of blue and can also be obtained at an art supply store. The reason you want such a large pad is that you'll be doing the drawing double size and reducing it later on. Leave yourself lots of room to work and make sure that the paper you use is at least four times larger than the intended size of your board.

### Drafting

Draw a horizontal line across the middle of the graph paper. You should be able to fit a double-size outline of your board's

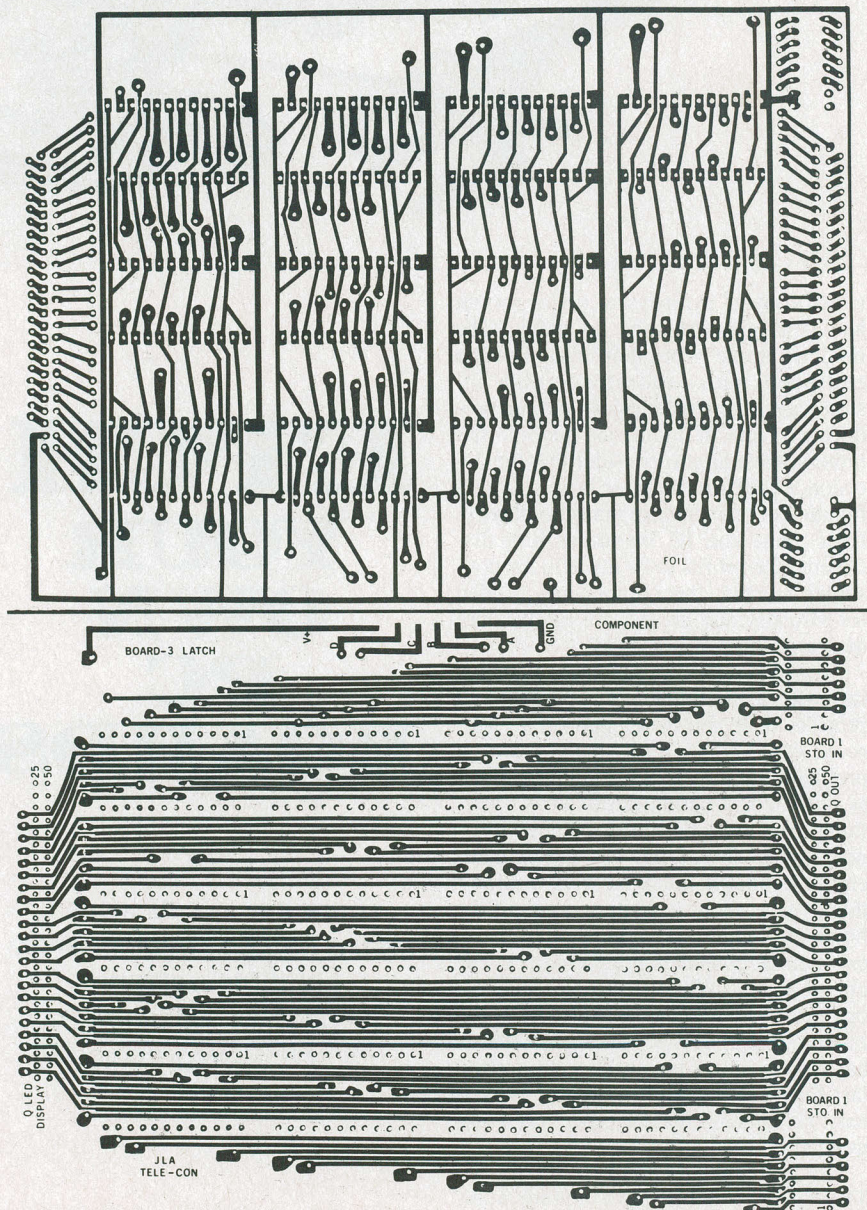


FIG. 1—DIGITAL-CIRCUIT FOIL PATTERNS often require long unbroken traces and double-sided boards with lots of interconnections. But even the most complicated patterns can be laid out and etched if you are patient and careful.



shape on both the lower and upper halves of the paper. If you can't, get larger paper. The reason for dividing it in half is that you'll be doing the foil pattern and the component layout at the same time. Not only that, but you'll be able to tell whether your board has to be single or double sided. Draw the outlines of the board in black using a fine-point magic marker. All the rest of your preliminary work will be done with blue pencils. This is the time to draw in the board extensions for edge connectors, or any other odd shape you need. Anything that has to be in a particular place on the board should be done in black. These are the "givens" around which the rest of the components have to fit. They are usually due to particular case requirements.

There are lots of schemes for doing a layout. Probably the best way to start is to draw the pins for the IC's. A good way to start the layout is to look at how the IC's were placed on your breadboard. Remember that you're working twice actual size so adjoining pins should be two squares apart. Since the physical dimensions of IC's are designed around 0.1-inch spacing, you'll find that everything fits neatly onto the paper. Place the IC's in neat rows and columns. That will make things easier when you start drawing in the traces and will make redundant connections obvious. Common connections such as power, ground, clocks, and so on will be much easier to lay in if the IC's are logically spread out on the paper. Make sure to indicate the IC pins on both halves of the graph paper and label pin number 1 on both halves to help keep everything straight in your mind.

Remember that you're not reversing anything—the bottom and top halves of the paper are being drawn as if you had laid both sides out flat and were looking down at them. Some layout schemes call for drawing the two sides of the board on top of each other in different colored inks.

Not only does that cause extra steps later on, but left and right get confused and it's really easy to make mistakes.

I wish I could give you some foolproof way of routing the leads but I don't know any other than trial and error. Be prepared to do a lot of erasing and redrawing because it takes a while to solve the topological problems caused by your circuit—there's no teacher other than experience. When you find that you absolutely, positively have to cross traces, break one of them and draw doughnuts at the ends. Locate the **exact same** positions on the other side of the board, draw two more doughnuts there, and draw a trace connecting them.

As you draw the connections for your circuit and put in the components, try to avoid using the component side of the board because single-sided boards are much easier to make. Unfortunately, however, digital circuitry often requires a double-sided board. If you accept that in the beginning, you can save a lot of grief by first laying out the address and data lines. The chances are that those traces will require a number of connections between both sides of the board. It's not at all unusual to have a trace jump back and forth from one side of the board to the other eight or ten times—if you can make the connection that way, do it.

The complexity of the foil pattern you generate will depend on a number of things. If the component density is high, the foil pattern will be busy. Obviously, the more connections you have to make, the more complicated the foil pattern will be. Interestingly enough, if your circuit has lots of passive components, you'll have an easier time figuring out a foil pattern. You'll wind up with lots of short traces and you'll be able to route the longer power and ground connections around them. Digital circuitry is tough because lots of direct connections have to be made between the IC's. That requires

long, unbroken traces and, unfortunately, lots of connections between both sides of the board (see Fig. 1).

## Double-sided boards

Sometimes you can simplify things by rearranging the IC's but if you're dealing with power, ground, clock, address, and data lines, there's no way you're going to be able to get them all on a single-sided board. Don't throw in the towel, however, as double-sided boards *aren't* that much harder to make. Piggybacking components and using loads of jumpers is a poor alternative to making a double-sided board.

You have to be really careful when you're working back and forth on the two sides of the drawing—make sure that the holes and traces line up properly. Use a straightedge and calipers, as shown in Fig. 2, and don't feel silly about counting squares—I've made a lot of double-sided boards and I do it all the time.

Once you've decided to make your board double sided, take advantage of the decision. There's as much copper on the component side of the board as there is on the foil side. It's rather strange to jam as many traces as you can on the foil side and leave only a few on the component side. Not only that, but the more evenly you distribute your traces, the more likely it is that the board will etch evenly. If you have 90% of your pattern on the foil side and just a few traces on the component side, you're running a serious risk of undercutting the traces on the foil side during etching. What's more, having lots of traces on the foil side means that some of them are going to be thin. While you're waiting for a veritable sea of copper to be etched on the component side, the thin traces on the foil side will disappear.

If you plan things carefully, the connection from one side of the board to the other can be made using the leads of the components. It's a simple matter to solder the leads on both sides of the board. For those traces that wander from one side of the board to the other, you'll just have to leave doughnuts and connect them with small pieces of hookup wire soldered to both sides.

The big problem comes when you have to deal with IC's. There are a few options: For one thing, you can solder the IC's directly to the board and make the feed-through connections by soldering the IC legs on both sides—but **don't do it**—always use IC sockets. You can mount the socket so that it is raised about an eighth of an inch or so above the board and solder the the socket legs on both sides of the board; of course, you'll need wire-wrap sockets to do that. I don't like that method because wire-wrap sockets are more expensive and physically larger than others. Also, having the socket sit above the board leaves the plastic part of the socket free to move and puts an undue strain on the legs. All things considered,

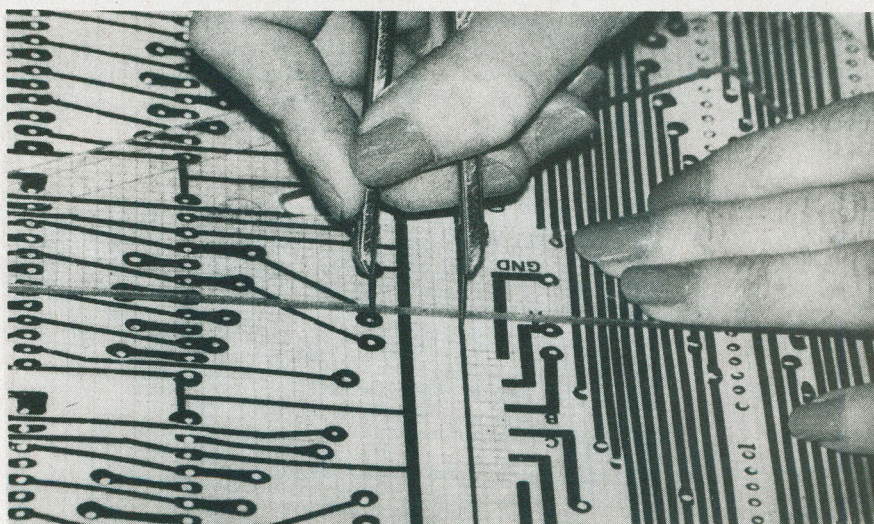


FIG. 2—WHEN LAYING OUT a double-sided pattern, one of the most important steps is to make sure that both sides line up properly.



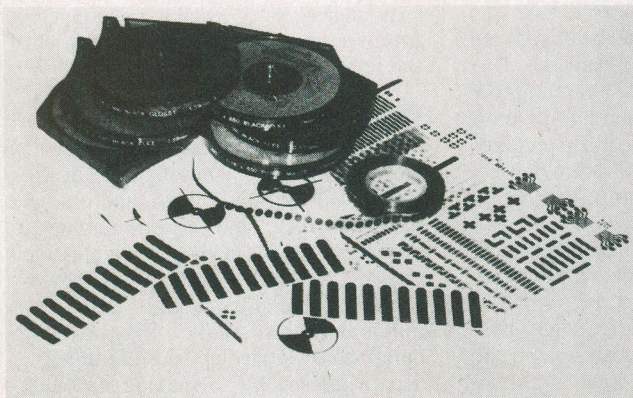


FIG. 3—DRAFTING AIDS, such as the ones shown here, can be very useful in completing your layout.

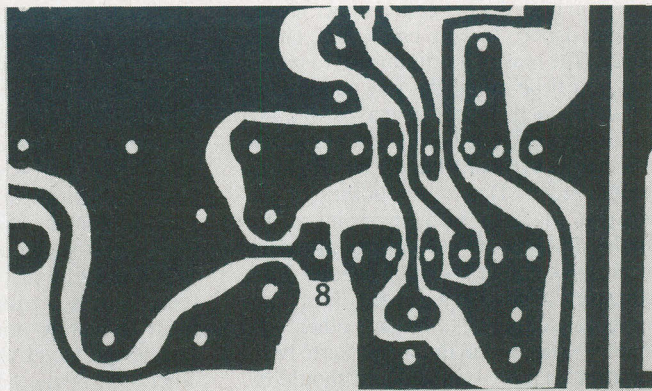


FIG. 4—IF TRACES MUST BE ROUTED between IC pads, elongate the pads to make soldering the components easier later on.

if your circuit is complex enough to require a double-sided board, you want to eliminate any potential problems, and mounting sockets above the board is a possible source of trouble.

What I do is to extend the trace on the component side and use small doughnuts on both sides of the board to make the connection from one side to the other. It's neater, and makes the board more secure and compact. After the board is etched, I thread hook-up wire through all the feed-throughs and then solder and snip them in one shot. Any other method leaves room for error and if you have a board with lots of connections, it's much too easy to forget the IC legs hidden under the sockets and then go crazy trying to figure out why the circuit won't work.

#### Further considerations

Whenever you add a component to your drawing, show the doughnuts on both sides of the board. Not only does that make the geography of the board easier to understand, but it will be the basis for a parts-placement diagram later on. When you have your drawing completed, draw the components in (remember you're working twice actual size) and make sure that there's enough room to fit them on the board. Count up the number of traces on the component side to see whether a double-sided board is justified. If there aren't too many, consider the idea of jumpers, instead. If you feel, though, that a double-sided board is necessary, make sure that you leave at least two squares between the traces and any component leads. That is particularly important around the IC's because you don't want the IC sockets to hide the traces on the component side. It's almost impossible to locate a small break in a trace if it's hidden under a socket, and it's even harder to correct it.

Once you have the drawing finished and have checked the hole alignment, make sure that the connections agree with the schematic. Take your time doing that because corrections are a lot easier to make at this stage than they will be later on.

#### Final artwork preparation

After everything has been verified, the next step is to prepare the board for photography. All that means is that you have to ink in all the doughnuts and traces you've done in blue pencil. Many of the commercially available drafting aids can come in handy here (see Fig. 3). Long runs can be made using black drafting tape and several companies sell IC pads and doughnuts in double-size patterns. When working double size, try to keep the traces at least  $\frac{1}{16}$ -inch wide and separated by at least  $\frac{1}{32}$ -inch. That's the absolute minimum, though—tiny traces have a nasty habit of disappearing in the etchant and small separations may not show up in the final foil pattern.

The only exception is when you find it necessary to route leads through the pins of IC's (which you should avoid like the plague—especially if you're doing a double-sided board). If you find that you absolutely have to route traces between IC pads, make the pads, rather than the trace, thinner, and elongate the pads parallel to the traces as shown in Fig. 4 to be sure you'll have enough copper to solder the pins to.

When you've finished that part of the layout make sure there aren't any breaks in the pattern. If you find any, color them in with a fine-point felt-tipped pen as shown in Fig. 5. Check the pattern carefully and if any of the traces or corners

look thin, use the pen to fatten them. If you make a mistake, cover it over with typewriter correction-fluid and redraw it.

Make sure your lines are as black as possible and are completely filled in—every bit of black you add now will become copper on the board. Also, try to anticipate any special problems. Will you be soldering any nuts on the board to mount a meter or power transistor? If so, blacken in an area large enough to provide copper for the nut. There are no hard and fast rules to tell you how much copper to leave on the board and everything depends on your application, and your patience. Just remember that the more copper you keep, the less you have to etch. Once I've gotten to this stage, I thicken every trace I can to make the etching process as simple as possible. It never hurts to have spare copper on the board and wide power and ground planes are never a bad idea.

There is one place where the doughnuts should be as large as you can possibly make them. That is wherever you have feedthroughs going from one side of the board to the other. The larger the doughnuts, the more tolerance you're going to have in keeping the top and bottom of the board in register later on.

When we continue this article, we'll put the finishing touches on the layout. We'll also show you how to transfer the layout to the copper board. **R-E**

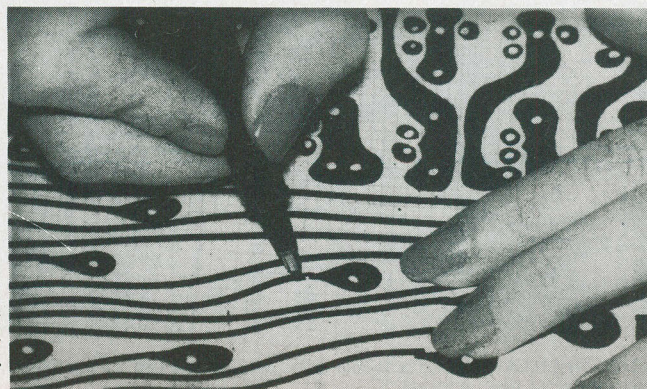


FIG. 5—REPAIR ANY BREAKS in the layout by filling them in with a felt-tipped pen.



SPECIAL SECTION

# **VIDEO** Radio- **Electronics** **ENTERTAINMENT**

## **A GUIDE TO VIDEO ENTERTAINMENT IN THE HOME**

Video Entertainment in The Home

New Video Components

Direct Broadcast Satellite Television

Video Accessories

How to Connect Video Components





# VIDEO ENTERTAINMENT

*The video revolution has changed the way we look at and use television. But has your set kept up, and will it keep up in the future? The following will help answer that question.*

## A. LEVIS

IT WAS ALL SO SIMPLE BACK IN THOSE EARLY DAYS OF VIDEO, BEFORE SONY's *Betamax* and Atari's *Pong* began to change the way we viewed the lowly TV set. In that ancient era, which began drawing to a close in the early 1970's, video simply meant television. The only choice one faced when shopping for video equipment was whether or not to blow the entire budget on that huge 25-inch console.

Unless you've been asleep these past few years, you know that those days are most certainly gone for good. Walk into any video store or department and you are likely to see VCR's (VideoCassette Recorders), videodisc players, projection televisions, television-component systems, VCR and cable-TV accessories, and perhaps even a complete satellite-TV earth station. You're also likely to find a great many computers and video games; we'll not say much about those products in this section, but you can be certain that the next year will feature the kind of new products and exciting advancements we've all now come to expect. What we will be looking at is video—the latest developments in the field, as well as what the near future holds. But first, let's look at what our old family TV-set has grown into, and why.

### Alternative programming

In the old days, television "quality" generally referred to a set's reliability rather than to the kind of image it reproduced. After all, few consumers would have been willing to lay out the extra dollars for such things as high resolution—even if the manufacturers had been capable of producing sets with such features—just to watch the generally low-quality fare offered by the networks.

That began to change with the advent of cable-TV services such as Home Box Office. That service, and others like it, offered viewers a real alternative in the form of recent movies, live sports events, and specials.

The real beginning of the so-called video revolution, however, began with the introduction of the VCR. That device gave the viewer almost complete programming control. Today, programming can be drawn from a vast array of pre-recorded videotapes, including the very latest movies (sometimes the videotape is released simultaneously with the movie's premiere); from both free (broadcast) and pay-TV services, or can be original—

the video camera allows your video programming to be limited only by your imagination. For those who demand the very best, there are now video accessories that help clear up many picture, color, and stability problems; we'll take a closer look at those elsewhere in this section.

A relatively new program source is the videodisc. Although those devices lack the recording capabilities of the VCR, and have not proven as successful in the marketplace as was predicted, there is still considerable hope that it will succeed as an alternative program source. Among its advantages are its lower initial outlay, as compared with a VCR, and its potential for use with a computer.





# IN THE HOME

Currently, satellite-TV reception is out of reach to all but a few. That too is about to change as an exciting new service, direct broadcast satellites, will be in place by the end of this decade. Aside from being yet another source of alternative programming, it may also offer such attractive features as high-definition TV and stereo sound.

## A new kind of TV

Although TV set manufacturers were slow in responding to the explosive growth of alternative programming and video-related products, they soon realized that their product was destined to become the centerpiece of a sophisticated, highly complex, and demanding electronic home information and entertainment system. They also realized that the conventional TV-receiver was inadequate for that purpose. There were many reasons for that, but among the most important was the way a signal is fed into the receiver. Up to recently, the only signal that the TV was required to handle was a combined over-the-air audio/video RF signal; that

signal was simply fed into the set through the antenna terminals. Once inside, the RF signal was demodulated, with the video information extracted and displayed on the screen. The result of that process was degradation of the signal that showed up as poor resolution, video noise, and the like.

With some recent exceptions, that's exactly how it's still done. But now, as we pointed out before, the TV set is being called upon to handle the audio and video information from a variety of sources. Those signals are still fed in through the set's antenna terminals, and on an RF carrier. As a result, that same modulation, demodulation, and extraction process still causes significant signal degradation. And what may have been acceptable for watching your favorite soap opera certainly is not when dealing with computer-generated graphics, videotapes, videodiscs, etc.

The standard television set also fails in another important area. The audio quality of most sets is poor. And while high-quality audio may not be particularly important for getting the most out of your video game or computer, some things that should happen in the near future will make TV audio more important than it has ever been before. One of those is multichannel, or stereo, TV-audio. Such audio has been available in Japan for many years now, and last year was introduced in West Germany. In both cases, the set manufacturers were prepared and had sets on the market by the time the service was approved. In this country, three TV-stereo systems have been proposed; as this is written, though, no commitment has been made to any of them, so neither we, nor the set manufacturers can be certain of which standard(s) will eventually receive acceptance. In the meantime, however, VCR's and videodisc players with stereo-audio capability are already on the market.

But help is on the way, thanks to a new generation of TV equipment designed to meet the high requirements of new and future video technology, and to be the centerpiece of that home-entertainment/information center of the future. The age of component television is here.

The term component television is currently used to refer to a wide range of products. In the past year, many of the leading set manufacturers, and some manufacturers that previously had dealt with audio products only, have introduced at least a few models designed to solve some of the video and audio problems we've mentioned. In some cases, they've simply taken an existing TV chassis and added separate audio and video input jacks. Doing that allows direct access to both video and audio circuits, getting rid of many of the problems associated with feeding an RF signal to the set. That helps, but you're still stuck with a receiver with limited flexibility, and limited growth potential.

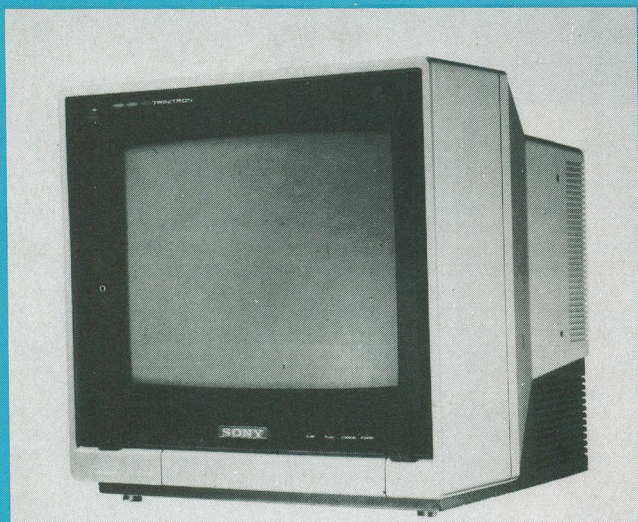




A better alternative is the true component approach. Systems of that type were first available last year from Sony (1 Sony Plaza, Park Ridge, NJ 07656) and Teknika (1633 Broadway, New York, NY 10019); now they are available from a variety of manufacturers. Those systems are by no means identical, and each manufacturer has its own idea as to how a component system should be configured. For instance, some offer a separate amplifier and monitor while others offer a combined package. Also, in some the tuner doubles as a switcher while in others those functions are handled by separate components. Since you now have a bit to choose from when picking your component system, it's important to match your needs to what's available.

#### What's available

The *Profeel* system from Sony remains unchanged from last year except for the addition of a new 12-inch monitor to the series. Like the larger 19- and 25-inch *Profeel* monitors, this one boasts good video resolution and offers an RGB (Red, Green, Blue) input. While currently that input will only be of interest to some computer hobbyists, it is hoped that will change with the eventual availability of RGB outputs on



THE NEWEST ADDITION to the *Profeel* line, is the model KX-121HG shown here. Like all *Profeel* monitors, it boasts RGB inputs.

consumer video equipment. The main advantage of an RGB input is that it allows you to bypass all of the signal processing stages in the receiver. The RGB signals are fed directly to CRT grid amplifiers. For the time being, however, such outputs are available only on professional equipment.

Sanyo (1200 W. Artesia Blvd., Compton, CA 90220) enters the field with their *Pro-Ponent* system. It features a 19-inch monitor with a built-in 5-watts-per-channel stereo amplifier, a separate TV-tuner with remote control, a companion stereo-audio sound system, and a pair of accessory speakers. The tuner has multiple inputs designed to accept a wide variety of sources (VCR, videodisc, etc.).

Zenith (1000 Milwaukee Ave., Glenview, IL 60025) was the first U.S. manufacturer to offer a component TV system. It includes a 19-inch monitor, TV tuner, a separate source-selector, a separate stereo-amplifier, and speakers. The monitor also has its own built-in audio amplifier and speaker and features both composite-video/audio and RGB inputs. The source selector allows the connection of up to six sources to the system. The tuner features an infra-red remote control and has 112-channel capability, including 42 for cable TV.

Several high-fidelity audio-component manufacturers have also come out with systems. Pioneer (200 West Grand Ave., Montvale, NJ 07645) is offering two screen sizes, 19- and 25-inches, with the larger monitor offering 400-line resolution, which is the highest claimed by any manufactur-



THIS NEW VIDEO-COMPONENT SYSTEM from Jensen offers a choice of tuners either with (shown) or without AM and FM-stereo.

er. The tuner is housed separately and features 127-channel capability and an infra-red remote control; the tuner also serves as the system's source selector, handling all of the switching functions.

Jensen (4136 N. United Parkway, Schiller Park, IL 60176) has a new entry that offers the consumer an additional choice. While many manufacturers are marketing systems with more than one monitor size, Jensen is marketing two tuners—one for AM and FM-stereo as well as TV, and one with TV capability only.

Even some smaller companies are getting into the act. NAD (675 Canton St., Norwood, MA 02062) and Proton (1431 Ocean Ave., Suite B, Santa Monica, CA 90401) are marketing systems built around the same 19-inch monitor, but will sell them through different outlets.

Component-TV systems are also available from Mitsubishi (7045 N. Ridgeway Ave., Lincolnwood, IL 60645), JVC (41 Slater Drive, Elmwood Park, NJ 07407), and others. And you can be sure that the list will grow considerably in the near future.

#### The future of video

Will your new video-entertainment/information system soon become obsolete? The answer to that is yes and no. No, because the U.S. is almost certainly tied to the 525-line NTSC broadcast standard for many years to come, although just about everyone involved with the technical end of the television industry—from broadcasters to set-makers—agrees that it is less than perfect. (For one thing, the resolution of current sets is not limited by technology, but by that standard.) Yes, because there are several developments that may soon result in higher definition television, with signals compatible with the NTSC standard.

Work is continuing on high-definition TV (HDTV), with much of it concentrating on developing a system that is NTSC compatible. RCA, for one, is involved in an intensive NTSC-compatible HDTV project, and believes such a system can be operational within this decade.

Another thing to look forward to is the arrival of digital TV. ITT in Europe is scheduled to begin offering set makers digital-circuit kits sometime next year, and such international companies as RCA, Sanyo, Philips of Holland, Sharp, Blaupunkt and Thomson CSF are involved in intensive research and development projects in that area.

But one of the chief advantages of a component system is its adaptability. It's relatively easy to modify your system to keep in step with the latest changes in technology, or your needs. So, don't let what's coming tomorrow spoil your fun today.

R-E



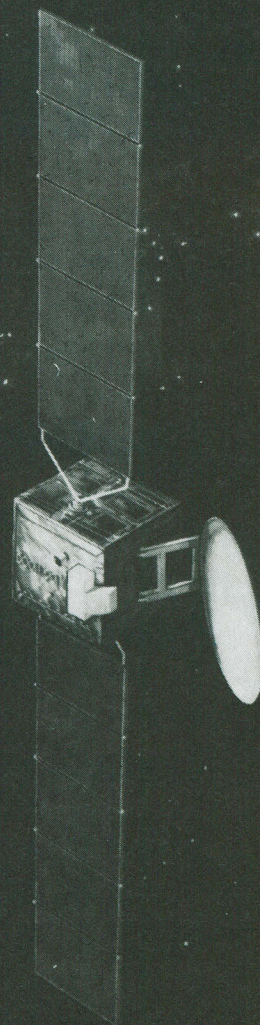
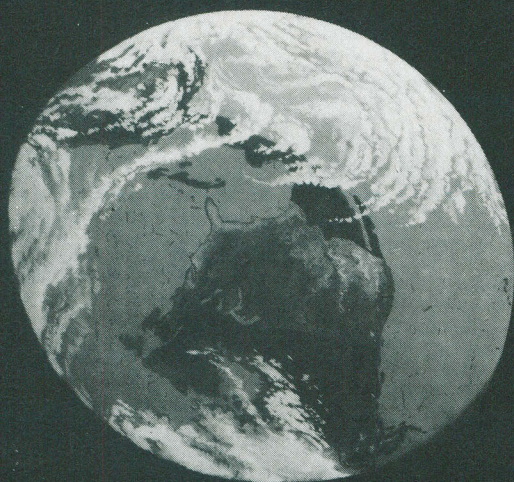
# DIRECT BROADCAST SATELLITE TELEVISION

*In this age of cable television, a proposed cableless system is getting quite a bit of attention. Here's a look at what DBS television is, and what it can mean to you.*

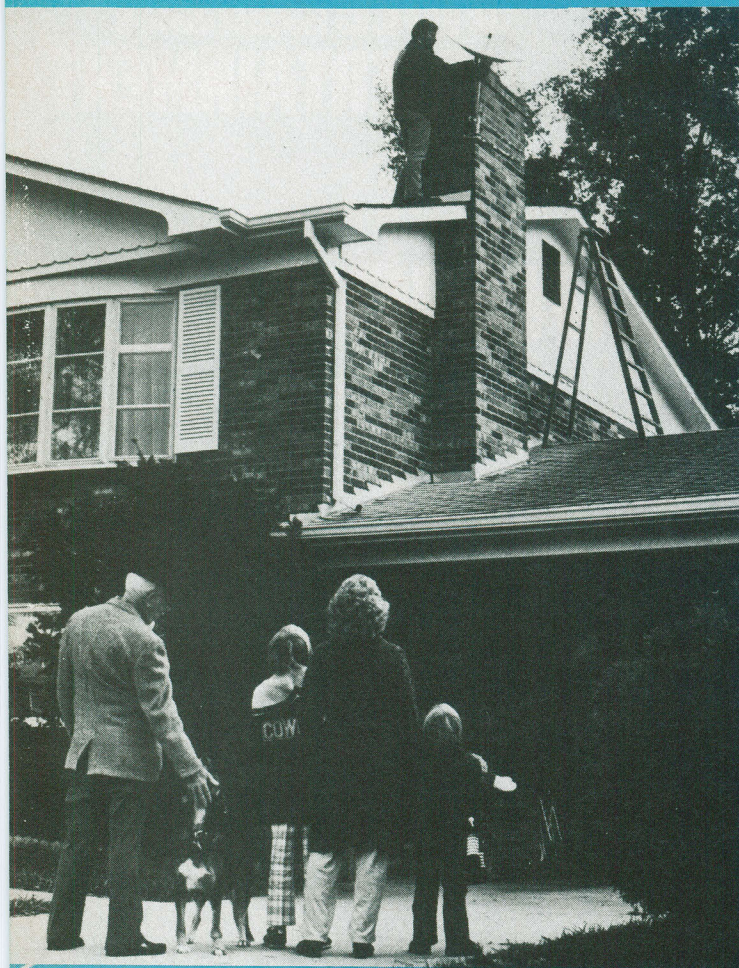
DANNY GOODMAN

AS THE WIRING OF AMERICA CONTINUES, CABLE TELEVISION is reaching more and more densely populated areas. Despite that, however, one industry report projects that as many as 48 million households will not be wired for cable TV by 1990. What's more, the U.S. government estimated that in 1980, 4.6-million homes could receive only one or two channels, while over one million homes were located in areas served by no television whatsoever.

But by the mid-1980's we'll see the beginning of a new type of television service—that service will have a potential of about 30 channels of programming and will be available in all parts of this country, whether it be the crowded island of Manhattan or the most sparsely pop-







THE SMALL SIZE and relatively low cost of a DBS dish antenna will bring satellite-TV reception within reach of most families.

ulated areas of Nevada or Montana. All you'll need to receive that service is line-of-sight exposure to a satellite parked in orbit some 22,300 miles up, a 2½-foot-diameter dish antenna, a satellite receiver, and your TV set.

At least eight companies have unveiled a variety of plans for Direct Broadcast Satellite (DBS) services, including advertising-supported programming (free to the viewer), subscription television (pay TV), and advanced video services such as teletext and High Definition TeleVision (HDTV). The success of those plans depends on a number of technical and regulatory issues that are as yet unresolved, but substantial amounts of money are being invested in the belief that DBS services will eventually become a reality.

#### Mini dishes

DBS services will differ greatly from the satellite-TV services currently in operation. The present generation of TV satellites generally receive high-powered signals from Earth in the 5.9- to 6.4-GHz range (called the *uplink* frequency), and retransmit them in the 3.7- to 4.2-GHz range (called the *downlink* frequency) using low-powered transmitters. The downlink transmitters are low powered primarily because each satellite carries as many as 24 transponders and each of those must share the limited power provided by the satellite's solar panels. The transponders carry TV and radio relays, as well as two-way communications traffic.

The retransmitted signal is so weak by the time it travels through the atmosphere that the receiving antenna dish needs to be relatively large (10 to 20 feet in diameter) to collect as much signal as possible and focus it on the receiver's sensitive amplifier, which is suspended over the dish's center.

Large dishes and highly advanced receiving circuitry built in small quantities make for expensive setups, ranging from under \$5,000 to over \$25,000 depending on your location and the number of different satellites you want to tune in. While that high cost, and the large size antennas required, may not present a problem to a cable-TV company, it does put home satellite reception out of the reach of many individuals and families.

The proposed DBS services, however, will use frequencies in the 17-GHz region for the uplink and frequencies in the 12-GHz region for the downlink. More important, however, is that the satellites will have transmitters capable of outputs of 150 watts or more. Contrast that to the satellites that are currently in service; those can only deliver outputs of about 5 watts or so. The greater power levels will allow a sensitive receiver to gather a useable signal from the smaller 2½- to 3-foot dish. At that size, a chimney-mounted satellite dish is no more cumbersome than a high-gain terrestrial-TV antenna.

Programming on the DBS channels may not be different from present satellite fare, but its intended audience will be. Currently, satellites are used primarily as a relay for broadcast and cable networks. In the original plan, retransmitted signals were to be picked up only by properly licensed ground stations for further distribution over a local terrestrial TV station or cable network. While the FCC has removed the necessity of securing a license for a TVRO (TV Receive Only) station, there are still some gray areas about the legality and/or ethics of individuals "eavesdropping" on relay satellites. Home Box Office, one of the more popular and outspoken satellite services has begun scrambling its signal, making it difficult for satellite aficionados to view their programs. Other satellite-distributed services may feel likewise threatened by the relatively small number of TVRO owners and scramble signals.

In contrast, DBS signals will be received by each individual subscriber, bypassing the need for an earth-based distribution system such as a cable system. Some cable systems may, however, wish to "subscribe" to a DBS service so that they can, in turn, offer the DBS services to their own subscribers.

#### Variety of DBS services

The proposals submitted to the FCC by the initial eight DBS applicants contained a number of different approaches. Satellite Television Corporation (STC), a subsidiary of COMSAT, was the first to submit a proposal, having done so in April 1981. Their plan (see Fig. 1) calls for a system of four active satellites, one for each of the U.S. time zones (the Pacific Time Zone satellite will also serve Hawaii and the more heavily populated areas of southern Alaska), plus two orbiting spares. The spares are intended to provide uninterrupted service in the event that one of the primary satellites fails. As early as 1985, STC hopes to have its first satellite (and one spare) in place, providing service initially to the Eastern Time Zone.

It is expected that each STC satellite will have three operating transponders (one for each channel of programming) and three spare transponders. With the high cost of each satellite and the long waiting list for room aboard a Space Shuttle or Ariane rocket, spare transponders and satellites are particularly important to prevent delays or interruptions in service due to equipment failure.

Three distinctly different program channels will be beamed from the 185-watt transponders. Only one, the so-called "Superstar" channel will run nearly 24 hours a day. Planned programming includes recent movies, popular concerts, theater, and family entertainment. The "Spectrum" channel will offer 15 hours daily of children's programming, classic films, performing arts, cultural programs, and public affairs. "Viewers Choice" will offer 15 hours of sports, educational/instructional programming, ex-



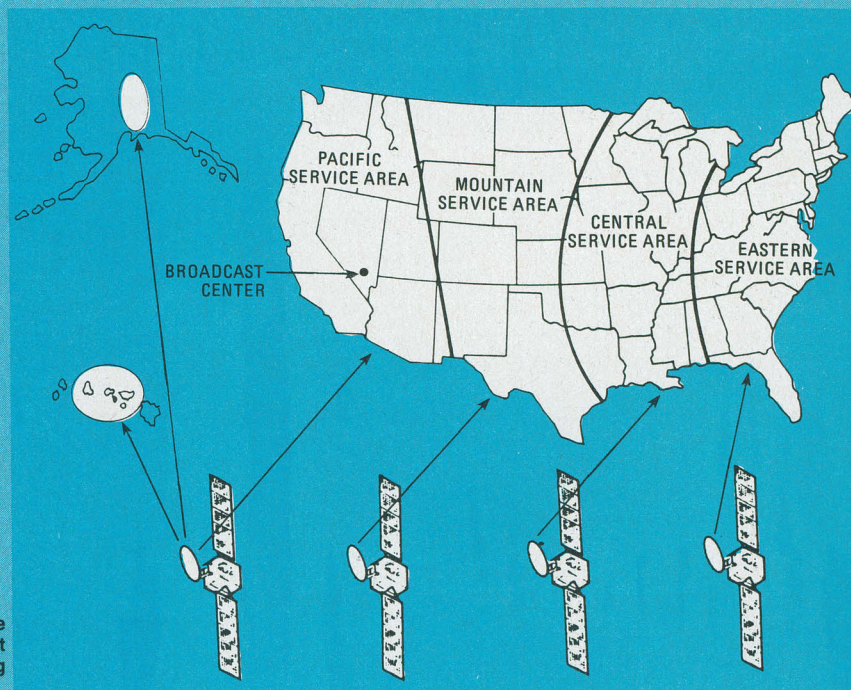


FIG. 1—STC'S PROPOSED DBS SYSTEM will cover the entire continental United States, as well as the most heavily populated regions of Alaska and Hawaii, using four operational satellites and two spares.

perimental theater, and the like. STC plans to "counter program," a scheduling method that tries to satisfy as many different viewing tastes during a given viewing period as possible. The STC satellite network will also have provisions for stereo sound for concerts, simultaneous second language transmission for minority viewers, and closed captioning for the hearing impaired. It also will present a full range of teletext information services.

All three channels will be scrambled, and TV set decoders will be individually addressable (digitally coded signals corresponding to each home decoder's serial number will engage the decoder), allowing the possibility of pay-per-view or pay-per-series specials requiring an extra subscriber fee.

#### Free satellite TV

United States Satellite Broadcasting (USSB) is taking a different approach. Their initial plan calls for only two satellites to cover the four time zones. Each satellite would carry

six operating transponders, three for each time zone. An orbiting spare would have 12 transponders ready to fill in where needed.

But what is more striking about their proposal is that the three channels would be advertiser-supported—like our present commercial TV—and would therefore be free to any viewer equipped with a dish and satellite receiver. According to Stanley Hubbard, president of USSB, the company's DBS service will be like a fourth national commercial network, with member TV stations around the country. Local stations will act as news bureaus and will be able to sell original programming to USSB and advertisers for national broadcast. Local member stations, whether broadcast or cable TV, will be able to re-transmit the USSB programming in those areas where DBS dishes aren't practical or popular. That proposed system is shown in Fig. 2.

Planned programming on USSB's channels include a full-service TV channel (news, weather, entertainment, children's programming, etc.), a 24-hour news and information

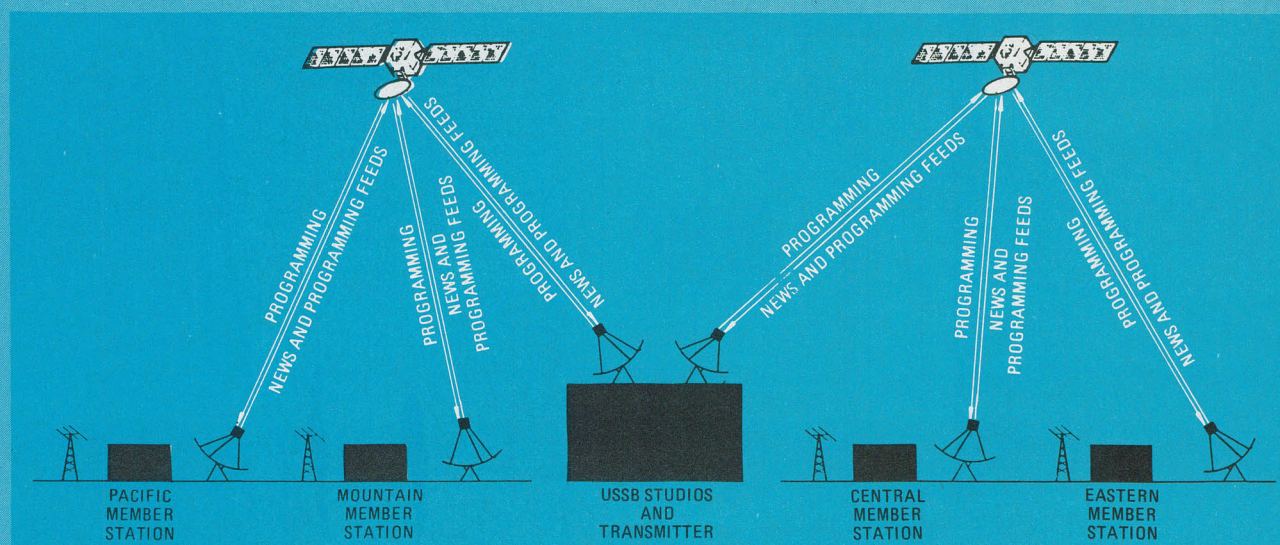


FIG. 2—IN THE USSB PROPOSAL, local member stations will feed news and original programming to the satellite "network" for national distribution. The local stations will also be able to rebroadcast the DBS services in areas where home satellite reception is either not practical or unpopular.



channel, and a third channel. Hubbard would not reveal what programming was planned for that third channel, but he did state that it will be "something original and unique."

Another way DBS satellites may be used is as common carriers. In other words, satellite companies will build, launch, and control the DBS satellites, but will lease the transponders to programmers or networks as is currently done with C-band satellites.

Pat McDougal of Direct Broadcast Satellite Corporation (DBS Corp.) foresees his company dividing the country into three zones, with one satellite covering each zone. Each satellite will have six channels, some of which could be used to transmit programming only to specific regions within the satellite's broader reception area; that reception area is often called a satellite's "footprint."

Although, as a common carrier, DBS Corp. would have no say in the programming going through its satellite, McDougal anticipates a mixture of advertiser-supported (free) and scrambled subscription or pay-per-view programming. DBS Corp., he says, is working toward a universal decoding scheme for all DBS satellites so viewers won't need a separate decoder for each service. There will also be a huge potential for FM stereo and teletext services through the DBS Corp. system.

### High resolution

For its part, CBS is looking to the sky to test and implement a major video development expected in the mid- to late-80's called HDTV (High Definition TeleVision. The intent of HDTV is to improve the resolution of the video picture in the U.S. from the current NTSC standard of 525 horizontal scanning lines to 1125 lines. The aspect ratio (the ratio of horizontal to vertical measure) would also change from the present 4:3, to 5:3, which more closely resembles the aspect ratio of theatrical films. Unfortunately, HDTV

signals will require a wider bandwidth than NTSC television signals because they contain much more information.

The CBS plan calls for four satellites (one per time zone), each capable of transmitting three HDTV channels. One channel would be used to feed HDTV programming to CBS affiliates for rebroadcast. A second channel would probably feature subscription and/or pay-per-view programming for individual subscribers. The third HDTV channel would be a professional service, most likely used for distributing HDTV movies to theaters, where they would be shown using a HDTV projection-television system.

As it appears now, HDTV signals will be incompatible with current TV receivers, and a report prepared for CBS indicates that HDTV sets will cost about 20% to 30% more than a standard television. But CBS is also looking at ways to make HDTV signals "transcodable," that is, to allow them to be viewed on NTSC sets also. In addition, work is being done by CBS and other HDTV developers to establish international standards to avoid the NTSC/PAL/SECAM compatibility problems broadcasters face today; work is also being done to find ways to reduce the bandwidth required for HDTV signals.

### Home receiver

To receive the DBS programming, each subscriber will need a home DBS receiver. To prompt potential suppliers to develop those receivers, STC early this year issued provisional specifications for their system's home receiver, a block diagram of which receiver is shown in Fig. 3.

The eventual cost of the home receiver is difficult to predict at this time. One reason for that is that work is continuing in an effort to reduce the cost of several of the critical microwave components. The GaAs FET's used in the circuit, for instance, cost between \$10 and \$20 each when bought in large quantities. Among other things, ways are being sought to improve the manufacturing yield (the ratio of

the good circuits or devices to the total produced) and to place as much of the circuitry as possible—including multiple GaAs FET's—on a single IC. That is turning out to be more difficult than with ordinary semiconductors, but researchers are confident that solutions will be found by the mid-1980's, when many of the DBS services are expected to begin.

Even with the uncertainties that remain, STC figures that consumers will need to pay "several hundred dollars" for the receiver electronics, or will be able to lease the receiver from the company for about \$25 per month, including the subscription to the basic three-channel service. Those that chose to buy the electronics can expect to pay \$14 to \$18 for the subscription alone. In addition, a one-meter dish antenna will have to be bought and installed at a cost of about \$100. Stanley Hubbard, of USSB, predicts that mass-produced receivers, capable of tuning all possible DBS channels in the 12-GHz range, will be available for \$250 or less. **R-E**

(continued next month)

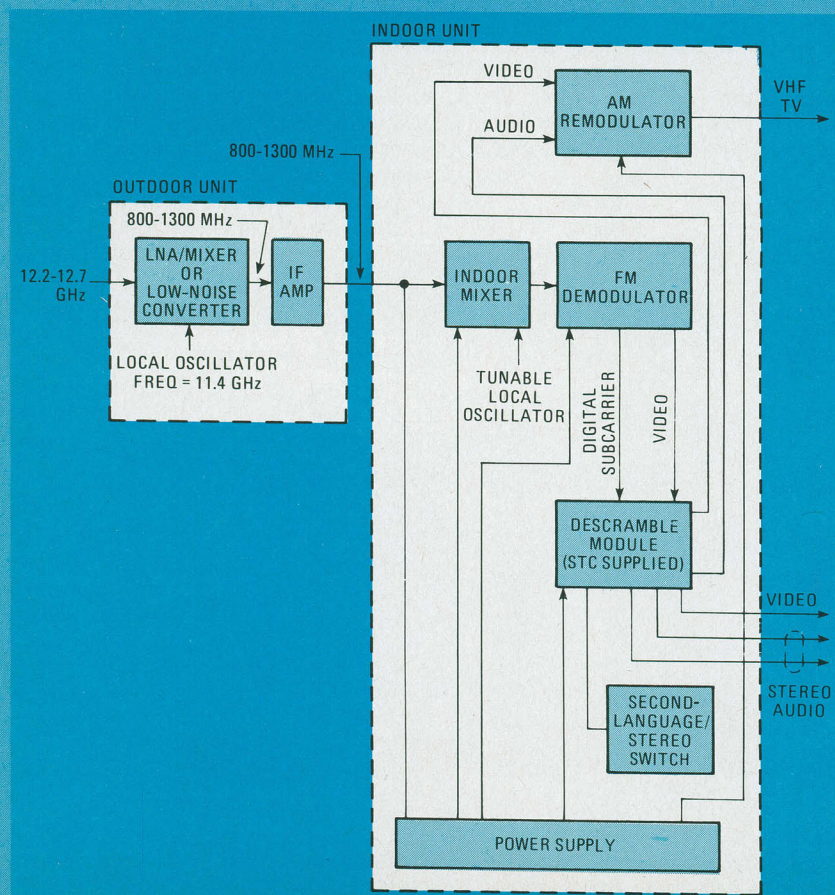


FIG. 3—BLOCK DIAGRAM of STC's proposed receiver. Descrambling will be handled by an STC-supplied module.



# NEW VIDEO COMPONENTS

*From the looks of things, the video revolution is nowhere near over. Here's what's new in home-entertainment equipment, and what to expect in the next couple of years.*

**DANNY GOODMAN**

IN THE LAST FEW YEARS, WE'VE SEEN THE INTEREST AND activity in video grow at an almost explosive rate, and there is no sign of that letting up. Consider, for instance, that VCR's continue to sell briskly; pre-recorded videotape rentals are way up; and, according to an RCA estimate, those who own videodisc players also own, on the average, a library of about 30 discs. It's also expected that video camera sales in 1982 may double those of the previous year.

Manufacturers of home video equipment are very much aware of the consumer's love affair with video. They continue to produce better performing, more advanced equipment in new shapes, sizes, and concepts—all designed to lure more of us into the video picture. And, from the looks of the trend-setting video innovations already here and expected soon, they're likely to succeed.

## Hi-Fi VCR

Stereo-audio for broadcast TV is still only in the planning stage in the U.S., but the absence of a broadcast

standard isn't preventing stereo from being included in several home videocassette-recorders. For now, stereo is limited to the upper end of the VCR price scale. In the VHS format, for example, top-of-the-line models from Panasonic (PV-1780), JVC (HR-7650), Quasar (VH5623UW), and General Electric (IVCR3018W) all feature stereo-audio inputs and outputs, including Dolby noise reduction. As high-end models, costing roughly \$1500 to \$1600, those units also have the deluxe special effects features and remote control offered on last season's expensive recorders. In the Beta format, Marantz has a home deck, the model VR200, with stereo and Dolby C noise reduction. That deck lists for \$1295.

Although there are few pre-recorded stereo-videocassettes currently available, there are other possible sources for two-channel audio, including FM simulcasts of TV concerts, stereo videodisc players, and your own dubbing. But, as stereo VCR's become more popular, you can be sure that much more pre-recorded material will become available. The quality of the audio, howev-





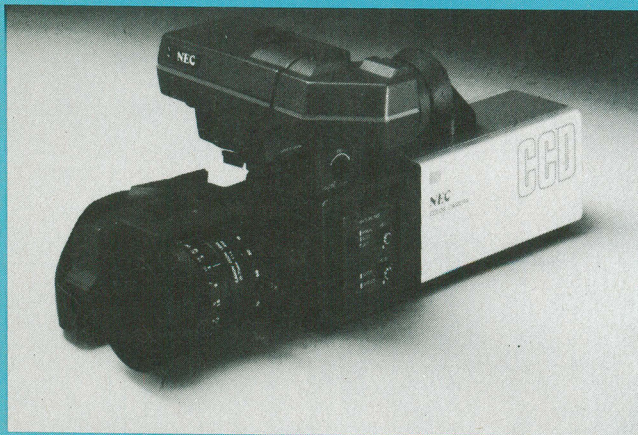
er, may not measure up to what you might expect from a hi-fi tape recording. The audio tracks on videotape are narrow, and the tape speed relative to the fixed audio tape-heads (ranging from 1.31- to 0.44-inches-per-second depending on format and selected speed) is slower than an audio cassette's 1 $\frac{7}{8}$ -inches-per-second. But if the stereo is played through a hi-fi amplifier and speakers, it will provide a spatial feeling and left-right separation that you can't get from any of the TV stereo-audio adapters currently on the market. And stereo isn't just limited to the home—a new portable VHS-format VCR, the JVC *HR-2650*, lets you record your own stereo material in the field. That unit sells for about \$1150.

Finding stereo in such compact recorders is not surprising considering that the trend in new portables is to equip them with as many features as the stay-at-home models. Today, the full-featured portable essentially breaks the home VCR's tape playing and tuning/timing elements into separate, mobile components. That arrangement offers the most in flexibility, since the VCR system can be a compact portable-recorder for remote taping with the addition of a camera, but can also act as a sophisticated home deck with such features as infrared remote control, multi-day/event time-shift programming, and special effects.

### The lightweights

The race is on in the industry to see who can develop the smallest and the lightest VCR. Sony's *SL-2000* (\$1150) and the Zenith *VR-9800*, which is sold with its companion tuner for \$1425, are the lightest Beta portables, weighing just 9.5 pounds. But several lighter (8.5 pounds) VHS-portables were recently introduced; those are built on the same Matsushita chassis and carry brand names like Magnavox, Panasonic, Quasar, General Electric, and Canon. Those units range in price from about \$750 to \$1500. The high-end models are full-featured VCR's that include, among other things, 14-day, 4-event programmable tuner/timers.

An intriguing new portable VCR was announced this year; it was developed by JVC and is called the *Ultra Compact Machine*, or UCM for short. It is just what the name implies. Though not yet available, Sharp has demonstrated a model of that machine, the *VC220*, which weighs just 5.8 pounds, including battery, and measures approximately 7  $\times$  2 $\frac{3}{4}$   $\times$  9 $\frac{1}{4}$  inches. The key to the UCM is the *VHS-C* ("C" for compact) format cassette. About the size of a pack of cigarettes, a *VHS-C* cassette contains enough  $\frac{1}{2}$ -inch videotape for about 20 minutes of recording on a UCM recorder. You can playback the tape through a TV, or edit on to a longer-playing regular-sized deck. You can also slip the *VHS-C* cassette into an adapter that makes the tiny tape playable on a standard VHS recorder.



**SOLID-STATE IMAGE SENSORS**, such as the one used in this NEC *TC-100* color camera may eventually replace the cumbersome and power-hungry image tubes of today.

Many more home video-recordists are eagerly awaiting the all in-one camera-recorders currently under development by several Japanese companies. Those companies are working toward a uniform  $\frac{1}{4}$ -inch videotape standard to help avoid another battle such as the one over the Beta/VHS format. But the way things are going, even if a standards agreement is reached in 1983, it may be 1985 or later before finished products reach the store shelves.

Still looking to the future, most of you are probably familiar with the  $\frac{1}{4}$ -inch VCR format—CVC—from Japan's Funai Electric. In the U.S., their small, five-pound portable recorder is sold by Technicolor. But an even smaller recorder, using the same CVC format, will be marketed in the U.S. in 1983 by Grundig. Grundig, a popular brand in Germany, has been selling their five-pound *VP-100* successfully in Europe. It measures only 4 $\frac{1}{4}$   $\times$  2 $\frac{3}{4}$   $\times$   $\frac{1}{2}$  inches and can be easily mistaken for a portable audio-cassette player; among its features are variable speed and freeze frame.

### Lights, camera...

The producer and director in us all will appreciate the features found on advanced color cameras. General Electric's two newest cameras, for example, both feature automatic focusing, relieving the cameraman of that chore. The more expensive of the two, the model *1CVC3035E*, which sells for \$1350, uses a *Newicon*-style pick-up tube that is designed to reduce "picture lag"—the tendency of an image to persist, thus streaking when the camera pans away from it. In addition, a control panel on the camera gives the operator fingertip command of fade-in/fade-out between scenes, and a built-in character generator capable of adding titles of up to 60 characters.

An exciting bit of news is the development of advanced solid-state imaging devices. Those, it is hoped, will eventually replace the power-hungry and cumbersome image tubes found in most of today's cameras. The heart of Hitachi's *VK-C2000* color camera, for instance, is a one-IC MOS image-sensor. That sensor, which is about the size of a postage stamp, consists of wafers of color filters over an intricate grid of semiconductor material. The material appears to be impervious to the burn-in that many cameras suffer when the lens is directed at a bright light. With its electronic viewfinder, the compact camera weighs only 3 $\frac{3}{4}$  pounds, but carries a heavy price tag—about \$2,000.

Another type of solid-state image sensor is a CCD (Charge Coupled Device). NEC, for one, is currently developing a CCD color camera. The CCD in that camera will consist of a mosaic of 384  $\times$  490 picture-elements and is expected to produce 250 horizontal lines of resolution. And, while the cost of cameras with solid-state image sensors will initially be very high, as manufacturers find ways to produce those sensors more efficiently, that cost should drop significantly.

For the do-it-yourself recordists, several new accessories can be very helpful for producing more varied programming. Although converters that let you videotape 35-mm slides for home-spun travelogues have been available for some time now, Sony has introduced a more advanced version, the *HVT-3000* (\$179.95), that gives you the option of doing the same with print film negatives when used with their model *HVC-2400* (\$1250) color camera. That camera converts the negative images to positives before they're recorded using a standard color video-camera.

More dramatic and professional productions can be done using Sony's new *HVS120K* special-effects kit, which consists of a model *HVS-2020* black-and-white camera, model *HVS-2000* special-effects generator, graphics aids, etc. If the kit is used with a color VCR-camera, you can superimpose either titles and graphics (from a six-color palette), or any image from the black-and-white camera, over the color-camera image. A slide-control fades titles in and out for quite a professional look. The generator also lets you alter color



keying (up to six different colors), which can make for some interesting "sci-fi" footage—as does electronic black-and-white reversal. The kit, which should be available by the time you read this, is expected to sell for around \$550.

Anyone with real creative talent will want to be first on the block with the *Video Scribe* electronic color-video titler (\$795), from Comprehensive Video Supply Corporation. You can be a real artist, using the device's 80 letters, numbers, and graphic elements, all addressable by a flat-membrane keyboard, to draw colorful titles and animation sequences in 8 colors—red, green, yellow, blue, buff, powder blue, orange, and magenta. Graphic output goes directly to the video input of your VCR.

### Videodiscs

Videodiscs aren't generating all of the excitement they did about a year ago, but the two current formats, RCA's CED and Philips' LaserVision optical format, have been making some news as more consumers are selecting videodiscs as an alternate program source.

New on the scene are stereo CED players from RCA, Toshiba, and Hitachi. RCA now offers two stereo models, both of which contain CX noise-reduction decoders (stereo CED discs are CX encoded). The top-of-the line *SGT250* sells for about \$449. That model features infrared remote control and an automatic start function, which replaces the front-panel control lever. Toshiba offers a \$90 accessory that allows owners of their monaural CED-players to get the full benefit of CX-encoded stereo discs.

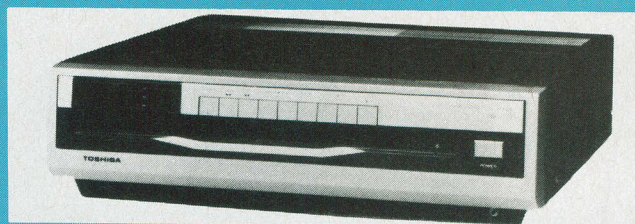
The LaserVision group also has chosen CX noise-reduction. Two North American Philips companies (Magnavox and Sylvania) have newly styled stereo LaserVision players, featuring remote controlled random frame-access and special effects. Those players sell for about \$750 and are made for N.A.P. by Pioneer.

LaserVision backers are still looking toward the future with the knowledge that their optical videodisc-players can be more than simple playback devices. North American Philips (Magnavox and Sylvania) has been demonstrating how their players can be used interactively with home computers. Interfaces exist now that allow computers like the *Apple II* and Texas Instruments *TI-99/4A* to control a videodisc player's search and frame-access functions. Soon, we're likely to see very realistic video-game-type interactive video based on such a setup. The use of a videodisc will allow for realism unmatched by any other home or arcade game.

### Video separates

With all of the new video sources available, you need something to use for display. That display device is, of course, your home television set—but even it is undergoing some major changes. For one thing, more and more sets are including separate video and audio input jacks in addition to the antenna-input terminals. Previously, the video and audio signals from a VCR or other video source had to be fed into an RF modulator, with the modulator's RF-output fed to the set's antenna terminals. The set would then demodulate the RF signal to extract the audio and video information. The addition of the separate audio and video inputs skips all of those steps and eliminates the losses caused by them.

Even more significant, however, is the trend toward video separates or components. In a component TV-system, the TV set is broken up into separate units; just how it is broken up varies from manufacturer to manufacturer, but often the system is made up of a separate video monitor, tuner, controller/switcher, and speakers. The monitors used in component TV-systems are capable of high-quality displays, but there is a premium to pay for that quality, and for the flexibility that those units can offer. For instance, Pioneer's *Foresight* 19-inch monitor lists for about \$850, while their 25-inch monitor lists for \$1500; the companion tuner for those lists for about \$500. Also, you should bear in mind that



AMONG THE FEATURES of this VP-500 CED videodisc player are stereo audio and CX noise reduction.

the displayed video can only be as good as what is input.

But, on the positive side, with a component approach to video you have the flexibility to build your system one piece at a time. With Sanyo's *Pro-Ponent* series, for instance, you can start with their model *AVM195* 19-inch monitor (\$600) and their model *AVT95* tuner/controller (\$400). The audio outputs can be fed to a separate stereo audio-amplifier and played through stereo speakers; the monitor also has its own built-in five-watt-per-channel stereo amplifier.

Zenith takes the component approach a bit farther. In its *Hi-Tech* system, all of the components feed into a central source selector, the model *CV-540*. That is one system in which the tuner and selector are separate units. The tuner here, the model *CV-510* lists for \$279.95, and features an infrared remote control. Getting back to the source selector, that \$169.95 component can accept up to six video and audio inputs. The video inputs and mono audio-inputs are routed by the selector to the system's model *CV-1950* 19-inch monitor, which lists for \$469.95; stereo audio-inputs are routed to a 20-watt-per-channel stereo amplifier that lists for \$149.95. That amplifier, the model *CV-520*, is designed specifically for the component TV-system; some manufacturers simply use one from their standard audio line. The amplifier also has phono and auxiliary inputs for adding hi-fi audio sources to your system.

Like many of the other new component-TV monitors, the Zenith monitor has an RGB (Red-Green-Blue) input. While such outputs are currently available on only a few consumer products, such as the IBM *Personal Computer*, they offer a great advantage. Unlike video-modulated RF (such as broadcast TV) or composite video signals, an RGB signal is fed directly to the video amplifiers, bypassing many stages of lossy signal conversion. With an RGB input, most component-TV monitors are capable of high-resolution displays.

A component-TV system, with its stereo amplifiers, speakers, and controller functions sounds much like a stereo-audio setup. In fact, it's getting harder and harder to classify entertainment as either all video or all audio; instead, it's simpler to consider the two as part of a broader home-entertainment category. Consider, for instance, Jensen's model *AVS 1500* audio/video receiver; it's an AM/FM- and TV-receiver, as well as a stereo amplifier, all in one package. The AM/FM receiver section features a synthesized AM/FM-tuner and a digital frequency-readout. On the TV side, there's a 133-channel (including cable channels) TV tuner and National Semiconductor's DNR (Dynamic Noise Reduction) circuit. The amplifier has an output of 50-watts-per-channel. The unit lists for \$990. Two companion monitors are available—the 19-inch model *AVS-3190*, which lists for \$800, and the 25-inch model *AVS-3250*, which lists for \$1030.

Teknika is another company that blends audio and video into the same components. Their \$1200 *ATV-19* system consists of a 19-inch monitor, AM/FM/TV tuner, and 2 speakers. A 25-inch monitor is also available.

### Tiny TV's

There's been a great deal of interest in small-sized TV and this year the first commercial flat screen (or pocket) TV's may become available. Sony's 2-inch diagonal screen





**POCKET-SIZED TELEVISION**, such as the Sony *Watchman* shown here, may finally become available this year.

*Watchman* uses a new picture tube design which places the electron gun below and parallel to the screen surface. The scanning electron beam is magnetically "bent" to hit the screen at a perpendicular; the result is a TV only 1 1/4 inches thick. The estimated retail for that set is around \$300.

Sinclair, developers of another bent electron-beam flat TV-tube, may get their 3-inch TV on the U.S. market soon; its price is expected to be in the \$100 range. Both the Sony and Sinclair tubes are black-and-white only.

The LCD flat-screen display is still under development, but may be still a year or two away. Seiko has been demonstrating a prototype of a wristwatch TV. Only the LCD screen is worn on the wrist. The bulk of the receiver, including an FM-stereo receiver, is housed in a vest-pocket sized unit.

Turning to small-sized color TV, Panasonic is offering what may be the world's smallest color TV/monitor; its *CT-3311* sells for \$499.95 and features a screen size of just 2.6 inches. It even has separate audio and video input jacks.

### Projection TV

From the very small, we turn to the "giants" of home video—projection TV. More companies are heading toward one-piece, rear-screen projection systems. They are typically more expensive than front-projection units, but recent scaling down of chassis size, as RCA has done for example, allows 40- to 45-inch screens to be placed in a cabinet that takes up no more floor space than a console TV. New for this year are many cabinet styles and sizes from General Electric, Mitsubishi, NEC, Panasonic, Quasar, Sharp, and Sony, to name a few; prices for those are in the \$3,000-\$4,000 range. Many like GE's new *Widescreen 40* feature built-in stereo amplifiers and twin, two-way speakers.

It may sound odd to put the words projection and portable together, but Kloss Video Corp has developed a portable (i.e. movable) projection-TV called the *Novabeam Model Two*. The unit is about the size of a 19-inch portable TV (though only 12-inches deep), and opens to project a 5-foot diagonal image on any wall. Room lighting needs to be controlled for best viewing, yet the ability to use a plain wall as a screen allows the unit to be played anywhere in the house and makes the viewing angle much less critical. Assuming that most projection-TV buyers have VCR's with TV tuners, Kloss eliminated the tuner completely from that model, which helped keep the price to about \$2200.

It appears, then, that there's more available in video this year than ever before. The so-called video revolution is continuing, and it's getting easier all the time to become a part of it.

**R-E**

### LIST OF MANUFACTURERS

**Canon U.S.A., Inc.**  
One Canon Plaza  
Lake Success, NY 11042

**Comprehensive Video Supply Corp.**  
148 Veterans Dr.  
Northvale, NJ 07647

**General Electric**  
Portsmouth, VA 23705

**Grundig AG**  
Kurgartenstrabe 37  
Furth, W. Germany 8510

**Hitachi**  
401 W. Artesia Blvd.  
Compton, CA 90220

**Jensen Sound Laboratories**  
4136 N. United Parkway  
Schiller Park, IL 60176

**JVC**  
41 Slater Drive  
Elmwood Park, NJ 07407

**Kloss Video Corporation**  
145 Sidney Street  
Cambridge, MA 02139

**N.A.P Consumer Electronics Corporation**  
I-40 and Straw Plains Pike  
Knoxville, TN 37914

**Marantz**  
20525 Nordhoff St.  
Chatsworth, CA 91311

**Mitsubishi**  
7045 N. Ridgeway Ave.  
Lincolnwood, IL 60645

**NEC Home Electronics**  
1401 W. Estes Ave.  
Elk Grove Village, IL 60007

**Panasonic**  
One Panasonic Way  
Secaucus, NJ 07094

**Pioneer Electronics**  
1925 E. Dominguez St.  
Long Beach, CA 90810

**Quasar Co.**  
9401 W. Grand Ave.  
Franklin Park, IL 60131

**RCA**  
600 N. Sherman Dr.  
Indianapolis, IN 46201

**Sanyo Electric Inc.**  
1200 W. Artesia Blvd.  
Compton, CA 90220

**Sharp Electronics Corp.**  
10 Sharp Plaza  
Paramus, NJ 07652

**Sinclair Research, Ltd.**  
50 Staniford St.  
Boston, MA 02114

**Sony**  
1 Sony Dr.  
Park Ridge, NJ 07656

**Technicolor**  
299 Kalmus Dr.  
Costa Mesa, CA 92626

**Teknika**  
1633 Broadway  
New York, NY 10019

**Toshiba**  
82 Totowa Rd.  
Wayne, NJ 07470

**Zenith Radio Corporation**  
1000 Milwaukee Ave.  
Glenview, IL 60025





## VIDEO ACCESSORIES

*With the three devices described below, there's no need to put up with poor-quality videotapes any longer. While they can't work miracles, they can make an amazing difference in the recorded image.*

GORDON McCOMB

THERE WAS A TIME NOT TOO LONG AGO WHEN THE AMATEUR video enthusiast endured videotapes with poor or shifted colors, fuzzy details, and picture instabilities. But as the home-video industry has grown to include millions of owners of videocassette recorders (VCR's), add-on components have been introduced to help clear up the annoying color, detail, and picture problems that have plagued videophiles for years.

There are three video components that no top-quality video system should be without (at least not for long): a color processor, an image enhancer, and a sync stabilizer. Color processors can shift, exaggerate, even delete the color information on signals from a tape, disc, camera, or any other standard NTSC format video source. Image enhancers improve the high-frequency response and help restore clarity and sharpness to old tapes, dubs, and less than perfect video equipment. The vertical sync pulses on many pre-recorded videotapes have been altered in an attempt to prevent unauthorized VCR-to-VCR duplication. Unfortunately, the circuitry in some TV's can't handle those altered sync pulses. That results in vertical hold instability and horizontal 'tearing' of the picture. To eliminate the problem, sync stabilizers are used to restore the altered sync pulses to their original shape.

Let's examine each of those components further, and discuss the ways they can be used to improve your video pictures.

### Color processors

Color processors enable full manipulation of the color and brightness components of any standard NTSC video signal. Colors can be shifted so that reds become green, greens become blue, and blues become red. The intensity of the image and colors can also be modified. A videotape with washed out colors can be rejuvenated by increasing the CHROMA or COLOR controls on a color processor. Special effects such as fading from a black-and-white to a full color scene can also be created.

The main function of the color processor is to correct for errors in the brightness, color, and tint of video signals, particularly with equipment lacking color and tint controls, as when dubbing between one VCR to another.

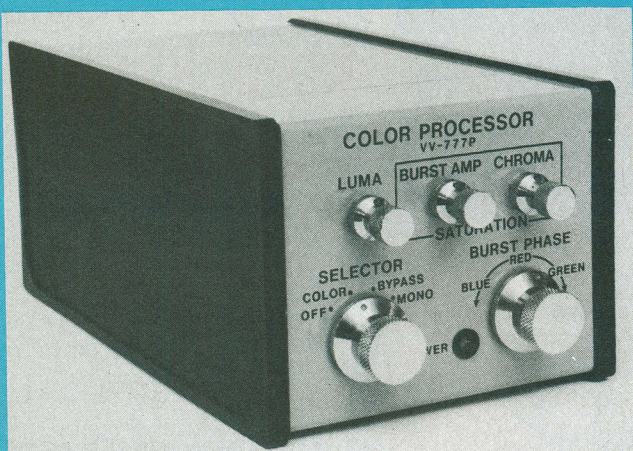
Three important fundamentals must be considered when reviewing the operation of television signals and color processors. Those fundamentals are luminance, hue, and saturation. The luminance signal occupies a bandwidth of 0 to 4.2 MHz, and includes all the brightness information seen in a black-and-white or color-TV picture.

Hue (adjusted by the TINT control on most color-TV sets) is the actual colors (red, blue, green, etc.) seen in a picture. Saturation (adjusted by the COLOR control on most color-TV sets) is the degree to which a hue is diluted by white light, enabling differentiation between vivid and weak shades of the same color. For example, a vivid blue is a saturated hue; a pastel blue is an unsaturated hue.

A color-TV picture consists of hue and saturation information, in addition to the black-and-white luminance information. The combination of hue and saturation is called chroma. The chroma signal is transmitted as a 3.58 MHz subcarrier of the luminance signal and consists of two color-difference signals, designated I and Q. The I signal determines the saturation, and the Q signal determines the hue. The I signal is transmitted as an amplitude modulation of the 3.58 MHz subcarrier signal, and has a bandwidth of 0 to 1.5 MHz. The Q signal frequency modulates the 3.58 subcarrier, and has a bandwidth of 0 to .5 MHz. A 3.58 MHz color-burst signal is inserted after every horizontal sync pulse in the composite video signal. The color-burst signal is used to synchronize the phase of the 3.58 MHz oscillator in the TV receiver, enabling proper color demodulation.

The instantaneous phase angle of the modulated chroma signal, with respect to reference color burst, controls the hue. The variations in the amplitude of the modulated chroma signal, in relation to the corresponding brightness

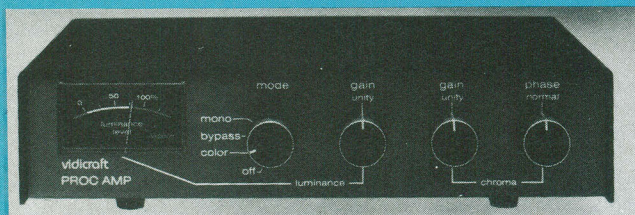




THIS COLOR PROCESSOR from Showtime Video Ventures features independent chroma and burst amp controls.

or luminance level of the scene, determines the saturation of the color.

Color processors can manipulate the amplitude and phase of the chroma signal, and thus can vary the tint and saturation of any scene. Old movies, either recorded or broadcast with weak color, can be rejuvenated by boosting the amplitude (saturation) of the chroma signal. Poorly taped home movies with incorrect colors can be corrected by altering the phase angle of the modulated chroma signal. Of course, there is no way to selectively boost, retard, or shift only certain colors with this type of color processor. If skin tones are excessively yellow, shifting the scene to normalize the skin color may also change the color of blue swimsuits to green. But those side effects, usually slight, are more than compensated for by the overall improvement of the video image.

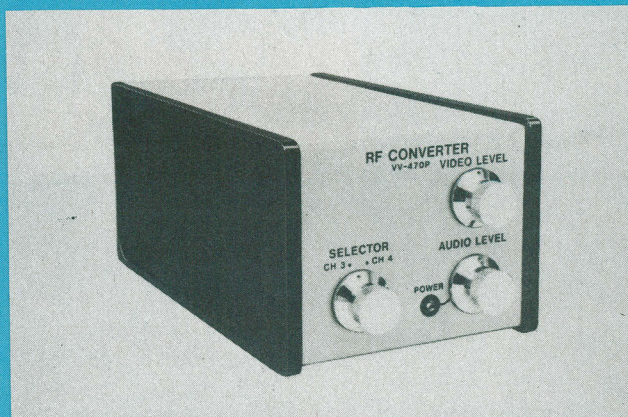


A TRUE PROCESSING AMPLIFIER, this unit from Vidicraft allows full control over both the color and sync of the video image.

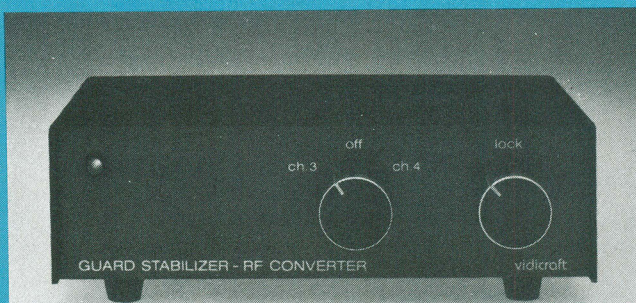
Operating a color processor, like the one manufactured by Showtime Video Ventures (2715 Fifth Street, Tillamook, OR 97141), is relatively easy. Showtime's color processor, model VV-777P, sells for \$377 and uses a MODE switch along with four front-panel controls for manipulation of the brightness, color saturation, and tint of a TV picture.

The LUMA control determines the relative amplitude of the luminance signal being processed. Decreasing the LUMA control darkens the scene; increasing the control brightens the scene. Color saturation is determined by the CHROMA and BURST AMP controls. The CHROMA control adjusts the amplitude of the color subcarrier with respect to luminance (hence the LUMA and CHROMA controls are interactive), and so alters the degree of color intensity. A BURST AMP control, unique to the VV-777P, adjusts the color-burst amplitude without actually affecting the subcarrier level itself, and is used as a fine adjustment for resolution and proper skin tone. Rotating the BURST PHASE control counter-clockwise a quarter-turn shifts reds toward blue, blues toward green, and green toward red. Rotating the BURST PHASE a quarter-turn clockwise will have the reverse effect. Secondary and complementary colors undergo a similar change. Switching the MODE switch to MONOCHROME squelches the color-burst signal, rendering a black-and-white picture.

Showtime's VV-777P color processor, like nearly all video components made by Showtime and others, operates with a demodulated composite video signal. To use the color processor with an RF signal (from the RF output of a VCR or from an antenna download, for example) the signal must first be demodulated by use of an RF demodulator. An RF modulator or converter is then used to remodulate the processed video to a suitable RF channel (usually Channel 3 or 4) for reception on a standard TV set. Most VCR's have separate RF IN/OUT and VIDEO IN/OUT connections, and in some instances, an RF demodulator and RF modulator may not be required.



AN RF CONVERTER or modulator is used to modulate separate audio and video signals for viewing on a standard TV.



SYNC STABILIZERS, such as this one from Vidicraft, are used to eliminate side effects caused by tape-duplication prevention schemes.

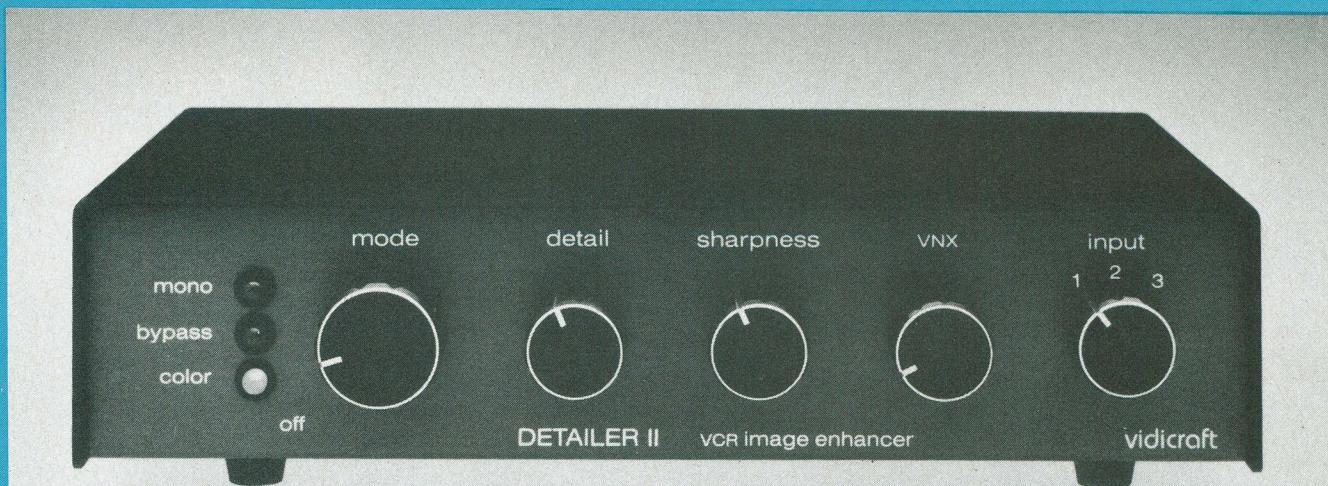
## Image enhancers

Image enhancers are used to improve the detail and sharpness of programs viewed off-the-air, while recording or playing videotapes, and during tape-to-tape duplication. Image enhancement involves boosting or accentuating high-frequency video signals, thus increasing overall detail.

The picture displayed on a TV screen is produced by varying the intensity of an electron beam (or three beams in the case of a color TV) as the beam sweeps across from left to right, and from top to bottom on the face of the picture tube. Extremely fine detail and outlines require the beam to vary its intensity more often—up to several million times per second. The smaller the detail in the image, the higher the frequency required to produce it. Likewise, the sharper the outline of an object, the faster the beam must cycle from light to dark or vice versa. Again, high frequencies are involved.

The bandwidth of the TV luminance (brightness) channel is from 0 to 4.32 MHz. However, high frequencies are often distorted and rolled off by the less than perfect circuitry used in most home VCR's and TV sets. That combined with the maximum bandwidth of most VCR's of about 2.0 MHz, leaves only a 0 to 2 MHz bandwidth for all the picture detail and information displayed in any given video frame. Reduplication of a videotape—three of four generations from the original—will yield a muddy, hardly discernable image





THE SHARPNESS AND DETAIL of both recorded and broadcast video can be improved by using an image enhancer.

where only the largest objects can be recognized.

The easiest way to think of an image enhancer is to look at it as a video version of an audio-frequency equalizer. But instead of dealing with audio frequencies, video image enhancers handle frequencies of 1.0 MHz and beyond. By boosting high-frequency signals, much in the same way as an equalizer or treble control boosts audio high frequencies, sharpness and detail can be improved. Low-frequency signals (0 to .5 MHz) are ignored by the image enhancer as they do not contain any detail or sharpness information.

Most image enhancers split the high-frequency signals into separate bands by using a comb filter, then selectively amplify the signals giving them an extra boost. Preshoots and aftershoots are added to the signal, driving the signal transitions (dark-to-light and light-to-dark) at a steeper amplitude than normal. That helps eliminate the soft edges in light-to-dark and dark-to-light transitions in the picture.

Of course, an image enhancer cannot produce something that isn't there in the first place. If the delineation of each blade of grass no longer exists in the image recorded on a videotape, no enhancer—no matter how well designed or made—will restore the lost detail.

Boosting the high-frequency content of a video signal also brings out noise, seen as snow. Most enhancers incorporate noise-reduction circuitry in addition to the main enhancement circuitry. The noise-reduction circuit reduces the level of enhancement to compensate for the introduction of snow, and usually works in direct opposition to the enhancement circuit. Noise, usually of high-frequency content, has a lower amplitude than most desired signals. Noise reduction circuitry is designed primarily to suppress low-amplitude, high-frequency signals.

For example, Vidicraft's (Box 13374, Portland, OR 97213) *Detailer I* (selling for approx. \$149) and *Detailer II* (selling for approx. \$295) incorporate a VNX control that suppresses noise. It performs the opposite function of the DETAIL control, but uses a different set of amplitude thresholds, thus removing a majority of the increased noise and a smaller portion of the enhanced signal. There are trade-offs to be considered when using an image enhancer, as excessive noise cancellation can totally counteract all efforts to enhance detail. The proper enhancement level for any given program, with relation to detail and snow, is performed by interactive adjustment of both the enhancement and noise-reduction controls.

Connecting an image enhancer to a video system is similar to the hook-up procedures for the color processor, in that all units on the market can accept demodulated video signals only. Depending on the installation, RF modulators and/or RF demodulators may be required.

The operation of an image enhancer, such as the *Detailer II* from Vidicraft, uses several knobs for enhancement control. The DETAIL control is used to compensate for detail loss encountered in VCR recording and playback. It can be used to exaggerate detail before the signal is recorded (and so precompensating for high frequency roll-off inherent in home VCR's) or to help restore a VCR signal on playback. The SHARPNESS control increases the overall sharpness of the picture whether the signal be from a tape, camera, videodisc, or off-the-air. The SHARPNESS control is adjusted for maximum edge detail without creating false, black outlines. The VNX control (also called CORE, NOISE SUPPRESS, or NOISE CANCEL on some other models and brands) helps reduce snow and other low-amplitude, high-frequency interference—however, at the expense of detail. It's function is very much opposite that of the DETAIL control and is most helpful when sharpness-only enhancement is used. Normally, fine adjustments of all three controls must be made to obtain the best results, and the settings must be optimized for each program.

It should be noted that image enhancers improve the horizontal resolution of a video image—that is, fine details that occur from left to right in a TV picture. Image enhancers, unfortunately, aren't tested for any given horizontal resolution standard or minimum, since the quality of the original program will determine the results achieved by the enhancer.

### Sync stabilizers

Many pre-recorded videotape program distributors, to protect against unauthorized duplication of their product, have altered the vertical sync pulses recorded on their videotapes. That technique, most often called *Copyguard*, (although similar systems with different tradenames are available) disables the sync circuits in a VCR. However, several side effects of sync alteration can appear on the screen of a standard television receiver. *Copyguarded* tapes have a tendency to make the picture on a TV screen roll and shake, as well as "tear" at the uppermost portion of the picture. Adjusting the vertical-hold control on the TV can correct for most of the problems, but many of the newer sets often have the vertical-hold control mounted inconveniently on the back of the chassis, or may even lack a vertical-hold control altogether.

Sync stabilizers restore the vertical sync pulses and provide sync stability to TV's and VCR's. In the NTSC broadcast standard used throughout the United States (as well as Canada, Mexico, and Japan), an electron beam scans 525 horizontal lines 30 times each second. Every picture then consists of 30 frames composed of 525 vertically stacked lines. The scanning process is actually done in a 2:1 interlace pattern, so 262.5 lines are scanned in one pass over the tube,



and the second 262.5 lines in a second pass. The scan lines of the first pass or field is comprised of all the odd-numbered lines; the second field is comprised of all the even-numbered lines.

When the beam reaches the bottom of the screen after each field, it is then directed to retrace back to the top of the screen, and repeat the scanning process again. The synchronization pulses required for the circuit to direct the beam to the top of the screen are contained in the vertical blanking interval.

Within that vertical blanking interval, six vertical sync pulses, bracketed on both sides by equalization pulses, are used to trigger the vertical sync circuits in the receiver (those pulses are at one-half the normal horizontal line rate). Vertical sync pulses have extremely long duty cycles of 87% (the longest duty cycle involved in TV sync timing). In most TV's, only one vertical sync pulse is required to trigger the vertical-sweep circuits. In VCR's, however, nearly all of the vertical-timing pulses are required to ensure full sync stability while recording.

Sync-alteration techniques, (again, there are numerous types currently in use), normally pass just one pulse—the remaining five pulses are changed or distorted.

Nearly all sync stabilizers currently on the market, such as MFJ Enterprise's (921 Louisville Rd., Starkville, MS 39759) model 1400 (selling for approx. \$80), reshape the vertical sync interval to the point where a stubborn TV or VCR will trigger properly. A timing circuit is normally used that triggers when the circuitry in the stabilizer detects the first vertical sync pulse. The stabilizer circuit then generates a single long pulse equal to the normal vertical sync interval (three horizontal lines long), overriding the altered signal produced by the tape. The sync stabilizer has a frequency adjustment to allow the unit to match its frequency with that of the incoming vertical sync pulses.

The actual half-line equalizing pulses of the vertical blank-

ing interval are lost by use of most sync stabilizers, meaning that the horizontal sync circuits in the TV lack a timing reference for three lines in each field, which can cause horizontal sync loss during the vertical blanking interval. This can create some picture instabilities as well as horizontal tearing at the top of the screen. Only one sync stabilizer, the Showtime Video Ventures' model VV-170P, recreates the pulses contained in the vertical interval. Usually, however, simply adding one long pulse to the vertical interval compensates for most of the serious side effects caused by *Copy-guard* or similar encoding, and produces a relatively stable, jitterless picture.

Sync stabilizers work only with demodulated video signals, although some units are now available with built-in RF modulators. To use a video-only stabilizer, the VIDEO OUT jack on the VCR is connected to the VIDEO IN on the stabilizer. An RF modulator is then used at the output of the stabilizer. It should also be noted that video processor components can be combined in one installation along with a sync stabilizer. Normally, there are no restrictions as to the order in which the components should be placed in the signal path. Be certain, however, that a sufficient video level (1 volt peak-to-peak) is supplied to the input of each component. Many video accessories incorporate distribution amplifiers (some with adjustable gain) that can be used to overcome excessive signal loss when passing the signal through several components. Video distribution amplifiers are available separately as well.

Quite a few video components have provisions whereby more than one input source can be connected to the unit at one time. A front-panel switch is used to select the desired input. Additionally, many units have several outputs allowing for multi-point signal distribution.

Operating a stabilizer requires the user to adjust one knob, the STABILIZE control. The control is usually readjusted for each tape viewed.

R-E



NEARLY ALL of the sync stabilizers on the market, including the one from MFJ enterprises shown above, reshape the vertical sync interval.



# HOW TO CONNECT VIDEO COMPONENTS

*Watching TV is no longer a matter of simply turning on the set and sitting back. Here's a look at some devices and ways to take the nuisance out of what should be a pleasure.*

**GARY McCLELLAN**

THANKS TO CABLE AND SUBSCRIPTION TV, TV GAMES, AND personal computers, television is becoming more interesting and useful than ever before—not to mention a lot more fun. Furthermore, VCR's (Video Cassette Recorders) and videodisc players are making available to us an even wider range of entertainment. And, on the horizon, there is the promise of interactive videotex, which can allow us to shop and be informed from the comfort of our living rooms.

Hooking up all the equipment needed to an existing TV set can become a bit confusing, especially if several devices are involved; this situation is becoming more and more common these days. Most people start out with a VCR, and over a period of time add other equipment, turning a TV set into a video system. Perhaps there's a cable box with a decoder for sports and movies; then a programmable TV-game for the kids, a personal computer for Dad, and so on.

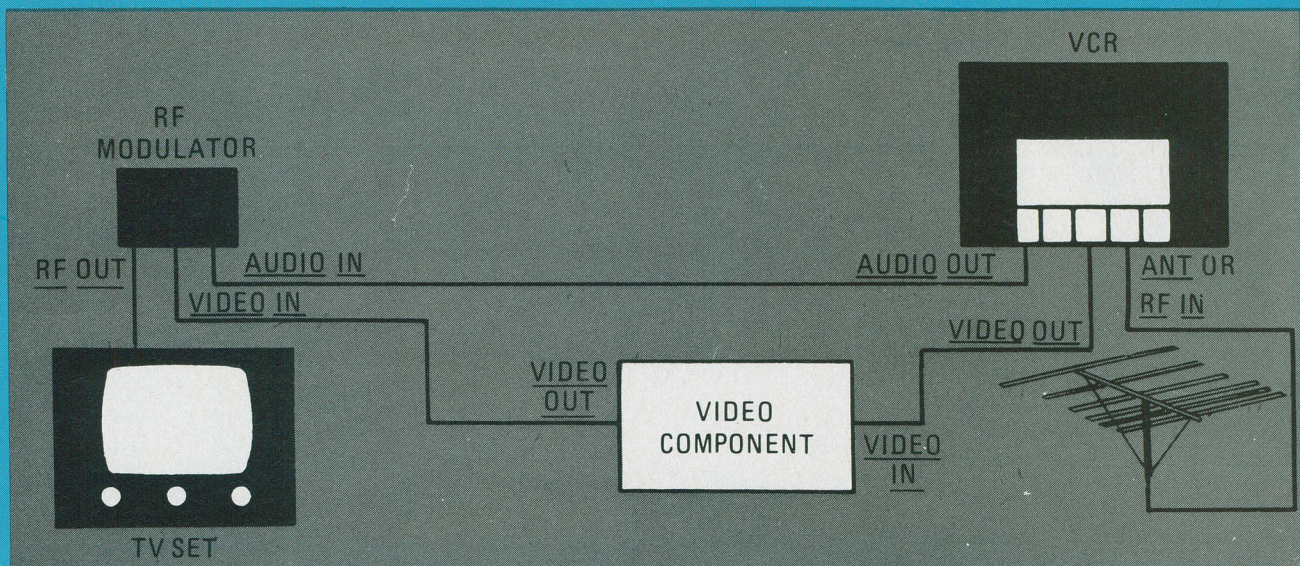
The result is often a rat's nest of wiring centered around a complicated switching arrangement. And, while *you* may understand it, it can make life very difficult for other people who use the system, especially if they have to change cables! Also of concern is the fact that every connection in that maze of cables causes signal losses that

can degrade picture quality. What's needed is an easy and simple way to mate all that new equipment with the TV set, creating a true integrated video-system that's easy to use and provides the highest quality possible.

In this article we'll discuss how to connect additional equipment to your TV set. We'll start with the simple addition of a VCR and build up to a "full house" video system featuring almost every device you are likely to want. We'll finish up by adding useful accessories such as cameras, enhancer/stabilizers, commercial editors, and others.

The hookups described will bring many benefits. For example, your video system will be easier for the family to use (no cable swapping), and there will be fewer connections and less signal loss. All you have to do is to read through the article to find the descriptions that best match your equipment, and then follow the diagrams to hook it up. It's as easy as that!

Of course, it isn't possible to cover every possible combination in this short space; there are just too many variations. Instead, we'll concentrate on the ones that most people are likely to use. With a little thought you should be able to adapt those ideas to your particular situation.





# Let's get

try out the in-stock selection of  
Heath/Zenith microcomputers,  
peripherals, accessories  
and software.

Now available at your nearby Heathkit  
Electronic Center, or through the Heathkit  
mail order catalog.

You get more with a Heath/Zenith per-  
sonal microcomputer system! We offer:



#### H89 Microcomputer

- Quality you can depend on with a name you can trust
- A powerful system at an affordable price
- An abundance of business programs to satisfy your needs
- Backed by a nationwide on-site service network

#### Why?

- Easy to learn
- Requires no secretarial assistance
- Self-taught in only hours to learn
- Increases efficiency both time and money
- Produces error-free professional documents



# personal...

- 1. Proven, high-performance hardware:** Thousands of our microcomputers are proving themselves daily, in the field.
- 2. Vast software library:** Three operating systems (including CP/M), languages, word processors, an electronic spreadsheet, versatile utilities and the 500-program Heath Users' Group software library.
- 3. Self-instruction courses:** Evaluation and programming courses from Heathkit/Zenith Educational Systems.
- 4. Service support:** Before and after the sale — consultation by phone, carry-in service.

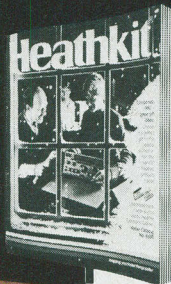
**Test run one of our microcomputers  
at any of the more than 60 convenient  
Heathkit Electronic Centers in the U.S.**

## Heathkit<sup>®</sup> ELECTRONIC CENTERS\*

See the white pages of your telephone book  
for store locations and telephone numbers.



\*Units of Veritechnology Electronics Corporation in the U.S.



Or if you prefer, send to the address below for a

### FREE catalog:

Heath Company  
Dept. 320-964  
Benton Harbor, MI 49022

In Canada: Heath Company  
1480 Dundas St. E.  
Mississauga, ONT L4X 2R7

Please send my free catalog, describing your complete line  
of microcomputer products!

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

CP-214 \_\_\_\_\_ Zip \_\_\_\_\_



## Basics

Before you do anything, there are few simple rules to remember when making these hookups, and they boil down to one thing—*go first class, inside and out*. Lots of people will spend a thousand dollars or more for a VCR, \$15 and up per month for subscription-TV service...and then use a 15-year-old antenna and rotten cables. Naturally, they get angry when their expensive equipment performs poorly. The moral is to save a little extra cash for a new antenna and lead-in. If you don't, you'll wind up paying for your "economy" with poor reception. Read the following basics, and apply them to your own situation. Make any improvements required.

Start outside with the TV antenna and lead-in, if you use them. They are often overlooked because rooftop mounting makes antenna inspection an unpleasant chore. Yet, if your antenna and lead-in have been up 4–5 years or longer, you may not be getting the best picture possible. Why? To begin with, the sun's heat and ultraviolet radiation degrade the insulators and lead-in, which means increased signal-losses. Also, soot deposits and humidity will cause breakdown of the cable insulation, and wreak havoc with connections. The result is predictable; more losses and noisy pictures! And, in extreme cases, corroded connections, combined with a nearby CB or ham transmitter, will invite interference. So if your antenna and lead-in are four years old or more, check them out carefully, and replace them if necessary. The same goes for lightning arrestors and guy wires.

If you are going to replace your lead-in, you should use coaxial cable, rather than twin lead. For one thing, it tends to reduce noise pickup, and for another, it is more compatible with the newer equipment. In my own case, using coaxial cable cut ignition-noise pickup noticeably and reduced ghosting; the extra cost was worthwhile.

Once the antenna and lead-in have been taken care of, the antenna should be carefully oriented for the best picture-quality on all channels. Often that requires a compromise, but with patience, things can be worked out. Of course if you have a rotator, antenna positioning will be no problem!

Go first-class inside the house, too. The lead-in cable should be routed to the area where the video equipment is located, and F-type connectors used. If necessary, use a VHF/UHF signal-splitter between the cable and TV set.

Now turn your attention to the TV set you will be using. It should be in good condition and provide a good color picture. Adjust the fine-tuning control for the best sound and picture quality. If you don't get a good picture and sound, repairs or adjustments may be required; have them made. You should then be getting first-rate results, and will be ready to add other equipment.

You are going to need baluns (impedance-matching transformers), short lengths of cable with F-type connectors on each end, and other parts. Refer to Table 1 for a list of parts of this sort that you will probably require.

## Adding a VCR

Video cassette recorders (VCR's) are very popular, and thanks to decreasing prices, are becoming quite widespread. Figure 1 shows a simple VCR/TV hookup. The antenna cable connects to a VHF/UHF splitter that goes to the VHF and UHF inputs of the VCR. From the VCR, separate cables are connected to the antenna inputs on the TV set.

Several remarks concerning that arrangement are in order. First, many older TV sets have balanced 300-ohm antenna inputs. To use the cable hookup shown, a 75–300-ohm matching transformer (balun) will be needed between the 75-ohm RG-59 cable and the TV set's VHF terminals. Don't try to do without the transformer or you may get a noisy picture. Second, some early VCR's don't have UHF output-terminals. If that's so in your case, run a short length of 300-ohm twin-lead from the VCR's UHF input-terminals to the UHF antenna-input on the TV set.

## Adding CATV/MATV

In some parts of the country, cable TV (CATV) or master-antenna TV (MATV) takes the place of an outside antenna. Figure 2 shows a hookup for such systems. Note that the switch box is not required if just one of those services is available.

Your setup may differ somewhat from the one shown, but can probably be handled in a similar fashion. For example, your area may have CATV and still permit outside antennas. If that's the case, just substitute the antenna cable for the MATV connection to the switch box.

Subscription-TV service has become popular, thanks to its uncut, no-commercials, format of movies and sporting events and the fact that the programming is sent over the air and no cable-service is required. Figure 3 shows two simple ways to connect a subscription-TV decoder to your VCR and TV set.

The hookup shown in Fig. 3-a will work well except for one thing: when the decoder is turned on, the VCR or TV will receive *only* the decoder! That can be a problem if there are two good programs broadcast at the same time on subscription- and free TV.

The solution is shown in Fig. 3-b. By adding the a device like the *Channelizer* (made by Energy Video Corporation, 20371 Prairie St., Chatsworth, Ca. 91311), it is possible to receive all channels without any switching. You can tape one program for viewing later, and watch the other program right now. Special circuitry inside the unit makes that possible without interference, and the decoder output appears on a channel unused in your area (channel 3 in mine).

There may be an unused input on the subscription-TV decoder that can be used to connect the output from any other video equipment (game, computer, videodisc player, etc.) to it, and you can then use those devices without throwing any

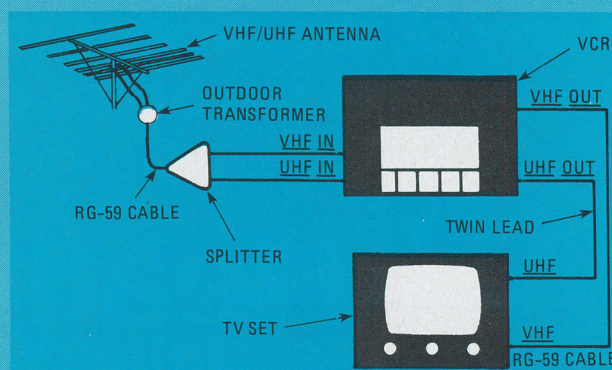


FIG. 1—CONNECT THE TV ANTENNA to your VCR, and then connect the recorder to your TV set. Keep the VHF and UHF signals separate.

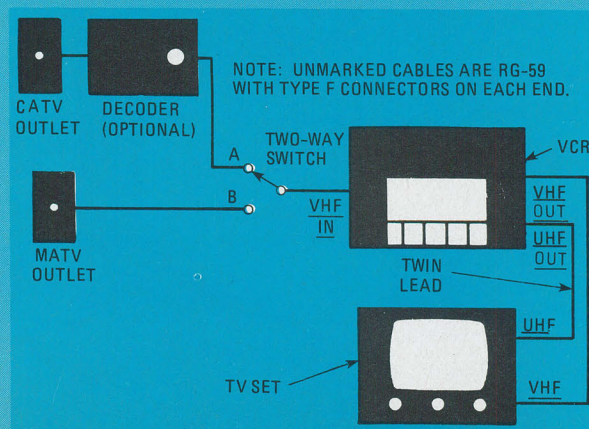


FIG. 2—A SIMPLE 2-WAY SWITCH will allow you to select between two TV-signal sources like CATV and MATV.



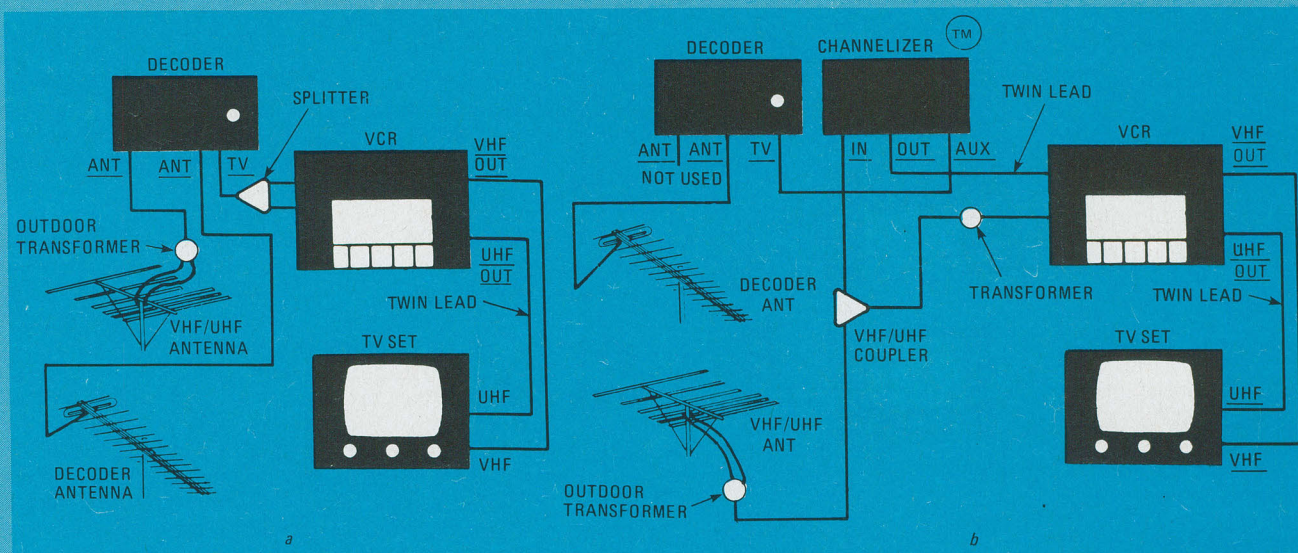


FIG. 3—A SUBSCRIPTION-TV DECODER in the line usually restricts you to receiving only one channel at a time (a). A device like the Channelizer (b) removes that restriction.

switches. Just set the TV set to your local "vacant channel," turn on the equipment, and go. That's great for the non-technical members of the family who hate to figure out switches!

### Adding other equipment

Add-on devices like video games, personal computers, and videodisc players are rapidly increasing in popularity, and making one part of your video system is easy—just use a two-position switch as shown in Fig. 4.

That arrangement does have a drawback; it allows you to connect only one device at a time. If you're lucky enough, however, to have a device with a VHF antenna-input (perhaps a videodisc player), you can "daisy chain" it with another device. Figure 5 shows how that kind of hookup can be made. You might be able to connect the output of your video game to the antenna input of the videodisc player, and the output of the player to the switch. Often that method will work well, and will eliminate a second switch. However, since not all video equipment has an antenna input, that hookup may not be practical for you! The solution, then, may be a video switch, our next topic.

### Getting sophisticated

All the hookups described so far have assumed that you would be adding just one device to your video system but the chances are that, with time, you will be adding several pieces of equipment. That can complicate things greatly if you are not careful, and you can end up with a rat's nest of cables. But take heart; there's a way around that problem.

This solution is simple enough: Use a multi-position video switch to select the output of a particular device for viewing on the TV set or for recording.

Actually, the term "video switch" is a misnomer. Those devices actually switch VHF/UHF RF signals, *not* low-frequency video, as their name would imply. However, since most manufacturers refer to their products as "video" switches, we'll do so, too.

The switches are sold under various names: *Bambi Electronic Video Switch* from Simple Simon Electronics (3871 S. Valley View No. 12, Las Vegas, NV 89103), *Video Organizer* from Zenith (1000 Milwaukee Ave., Glenview, IL 60025), and many others. All those products have one purpose: to switch in or out a number of program sources with a minimum of loss and crosstalk. They neatly replace the array of 2-position switches that are often used, and eliminate cable swapping. So, once your video system reaches the point where a 2-position switch won't be enough, or where

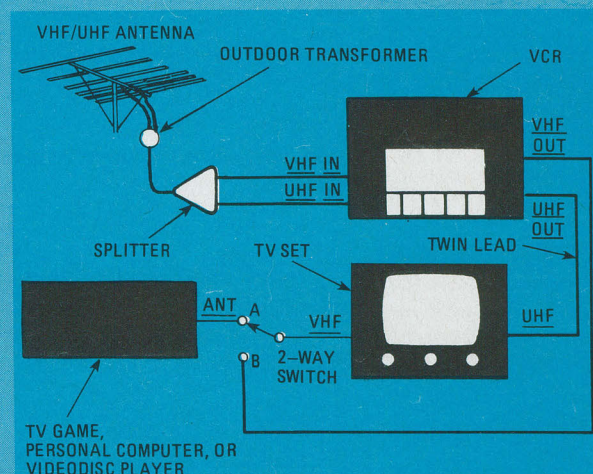


FIG. 4—USE A 2-POSITION switch to select between off-the-air TV reception and using an add-on video device.

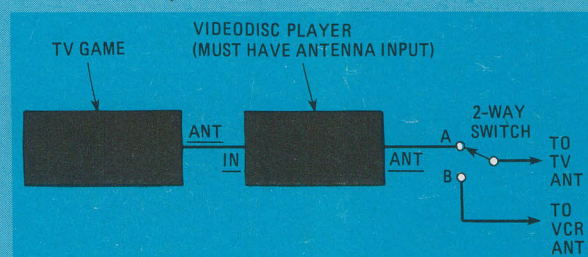


FIG. 5—"DAISY CHAINING," when you can do it, can reduce or eliminate the need for switches.

cable swapping is required, a video switch would be a wise investment.

To really appreciate how neatly a video switch simplifies cabling, suppose you add a video game, personal computer, and a videodisc player to your system. You could make the whole thing work by using the scheme shown in Fig. 4 and using three 2-position switches. Or, you could daisy-chain the devices as shown in Fig. 5. A better way, though, is shown in Fig. 6. There, a single video-switch takes care of everything and fewer cables and connections are required. That means less fuss in hooking the devices up, and less signal loss. But, best of all, using the switch is easy—all that you need to do is press the appropriate button to get what you want.



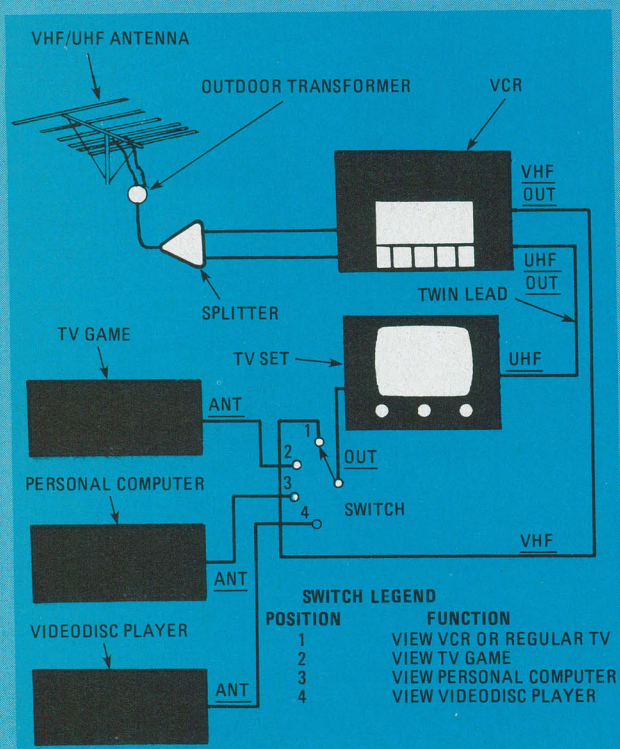


FIG. 6—A MULTI-POSITION switch will allow you to hook up several pieces of equipment to a single receiver easily.

### A full-house system

There are many people who take video very seriously, and, as a new item is introduced, they will add it to their systems. With each addition, the switching becomes more complicated, until most video switches become inadequate.

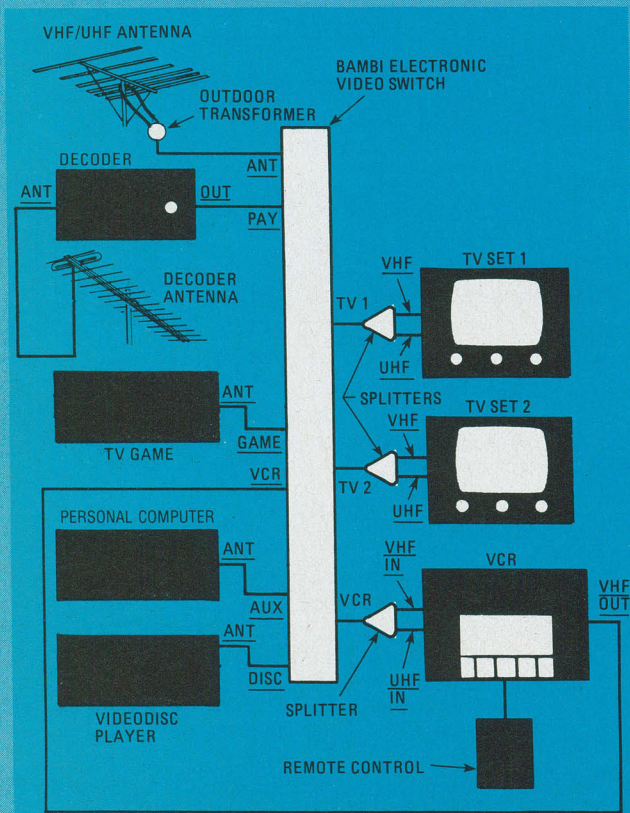


FIG. 7—"FULL HOUSE" VIDEO SYSTEM is easy with an electronic video switch. Any input can feed any output.

The solution to that problem is to select a more versatile video switch.

A setup for those who have "everything" is shown in Fig. 7. That particular arrangement is based upon the *Bambi Electronic Video Switch*. It can handle up to six inputs, and can route the signals from any of those inputs to any of three outputs.

The manufacturer quotes an especially high isolation-figure (65 dB) for the unit, which is important because that reduces interference among sources. Interference can occur because most inputs to a video switch are on the same channel (typically channel 3), and that can cause multiple pictures and interference lines to appear on your TV set(s). The solution is to use a switch with a high isolation-figure, indicated in dB. Watch for that specification when you buy.

As shown in Fig. 7, an outdoor antenna, subscription-TV decoder, VCR, videogame, personal computer and a video-disc player provide inputs to the video switch. Those devices can be switched independently, and the VCR can tape a program while the kids use the TV game and you watch another program off the air. A video switch makes it easy; in the case of Bambi, just press two buttons and go!

Selecting a "full-house" video-switch is easy. First, figure out how many devices you will be hooking up to your system. You will need a video switch with *at least* that many inputs, and—I would recommend—a spare or two. If you buy a switch without allowing for future expansion, you'll soon regret it.

There are plenty of video switches on the market, with a wide number of inputs and outputs, so scan the ads when you get ready to buy a switch. When you have narrowed your choice down to a few units, select the one with the greatest isolation figure, if those numbers are available to you. Once you have a video switch, just hook it into your system as shown in Fig. 7.

### Copying

There are times when it becomes necessary to copy material recorded on one VCR onto another. For example, I recently replaced my Beta-1 machine with a newer VHS model and had to re-record my old lectures and family outings onto VHS-format tapes as the new machine couldn't handle Beta-format tapes.

There are two methods that can be used for dubbing videotapes. You could use an RF hookup to the antenna terminals of the second recorder, but that would put a lot of signal-processing circuitry between the two machines and cause a reduction in picture quality. A direct-video/audio hookup using separate audio and video cables is preferred.

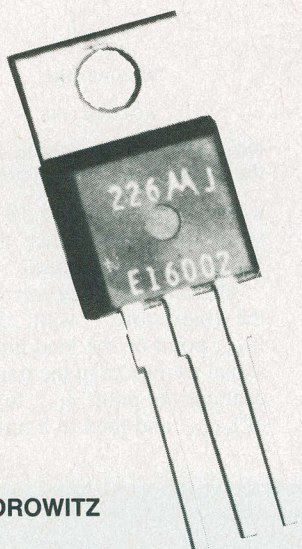
You may have to make the cables if you can't buy them locally. The audio cable can be standard audio or microphone cable with RCA phono plugs, or miniature phone plugs on the ends. The video cable should be RG-174 coax with RCA phono plugs on each end. The reason for using coaxial cable is to reduce losses. While a very short length of microphone cable could be used, it is very lossy and will reduce picture definition.

In some cases you may want to make a copy of an old tape that is of poor quality. Sometimes a video enhancer/stabilizer can make improvements in the quality, if the tape isn't too bad.

Enhancer/stabilizers are available from a wide range of suppliers (many of whom advertise in **Radio-Electronics**), and are very useful. The enhancer section of the device boosts—or peaks—the high-frequency portion of the video, which makes the picture look better. The stabilizer portion is used to stop vertical roll when some commercially available tapes are viewed on certain TV sets—especially some of the newer ones. Thus, the enhancer/stabilizer can be a valuable tool when it becomes necessary to copy tapes. **R-E**



## How to Design Analog Circuits —Multi-Stage Amplifiers



MANNIE HOROWITZ

*For most applications, you'll need more gain than you can get from a one-stage amplifier. This month, we'll show you how to combine one or more amplifier stages to get a more useful circuit.*

A SINGLE STAGE OF AMPLIFICATION MAY provide enough gain for some applications, but rarely, if ever, is the gain from a single-stage amplifier sufficient for audio or RF circuits. For those applications, the output from one amplifier stage must be fed to one or more subsequent stages to obtain enough gain. If that is done, the voltage gain of the first stage is multiplied by the voltage gain of the succeeding stages to determine the overall gain of the entire circuit.

Let's look at some of the methods that are often used to connect several amplifier stages together. Transformer coupling was, at one time, used quite often with audio amplifiers—especially in the power-output stages. Although it is still used for that, transformer coupling is now used mainly in IF and RF circuits.

Another method of coupling is through an R-C network. In that type of circuit, the output of one stage is connected to the input of another through a capacitor. In the previous article in this series (see the November 1982 issue of **Radio-Electronics**), we indicated that a capaci-

tor is used to couple a signal from its source to the input of an amplifier to isolate the source from the bias circuit. If the signal source and the bias circuit were not isolated in that fashion, the bias on the transistor would be altered by the signal source. That will also occur in a two-stage (or more) coupled circuit, but with an additional factor—in a circuit of that type, the collector voltage at the first transistor would affect the base current of the second. In turn, the current demanded by the base circuit of the second would affect the collector voltage of the first.

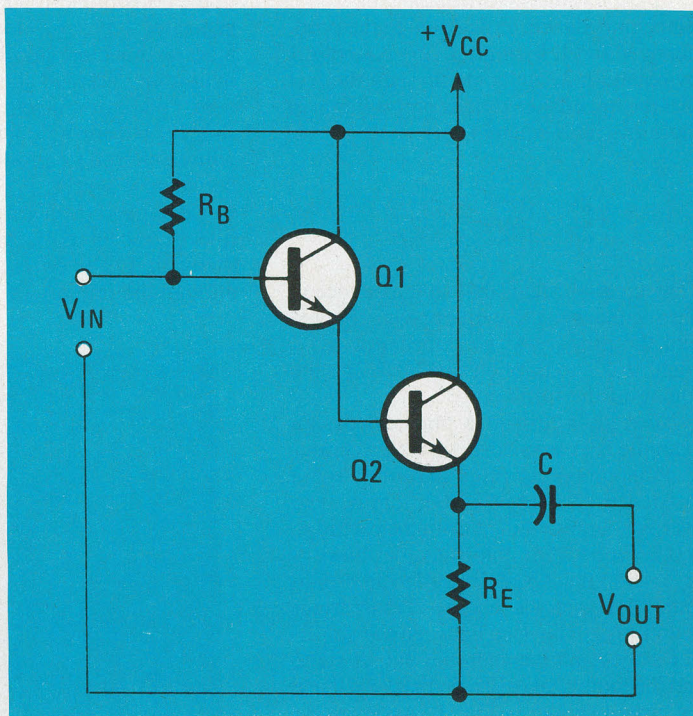
But that interaction can be accounted for and the circuit can be designed so that the use of a capacitor between the two stages is not required. That type of circuit is referred to as a direct-coupled amplifier and there are a number of advantages to using that arrangement, including better low-frequency response.

The circuits we will describe in this article all use bipolar transistors. Many of the problems encountered are not as severe in FET circuits. Thus, once you have mastered the design procedures for

bipolar-transistor circuits, applying what you've learned to FET circuits is relatively easy.

### Transformer-coupled circuits

The transformer has characteristics that make it useful as a coupling device. As you know, a simple transformer is made up of two coils of wire wound around a common magnetic-core. For the rest of this discussion, we will assume that one coil, called the primary, consists of  $N_1$  turns of wire, while the other coil, called the secondary, consists of  $N_2$  turns of wire. If a DC current were fed to the primary, a steady magnetic field would be induced in the primary and coupled through the core to the secondary, but no current would be induced in the secondary. If an AC current were fed to the primary, however, an AC current would be induced in the secondary. The signal in the secondary would have the same frequency and vary identically to the signal fed to the primary (assuming an ideal transformer, of course). If there were perfect magnetic coupling between the two





coils, the current appearing in the secondary (I<sub>2</sub>) due to the input current (I<sub>1</sub>) would be inversely proportional to the ratio of the turns in the coils, or:

$$\frac{I_2}{I_1} = \frac{N_1}{N_2}$$

The ratio of the voltages across the two coils is directly proportional to the turns ratio, or:

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

Since impedance, Z, is equal to the product of V and I, by multiplying equation 1 by equation 2, we come up with the fact that the impedance ratio is proportional to the turns ratio squared, or:

$$\frac{Z_1}{Z_2} = \frac{(N_1)^2}{(N_2)^2} = \left(\frac{N_1}{N_2}\right)^2$$

That equation states that an impedance in the secondary, Z<sub>2</sub>, will appear reflected into the primary as an impedance, Z<sub>1</sub>', equal to Z<sub>2</sub> multiplied by (N<sub>1</sub>/N<sub>2</sub>)<sup>2</sup>, the square of the turns ratio.

Now, let's turn to a practical design example. Let us say that we have a ceramic phonograph cartridge that must see a resistance of at least 22,000 ohms. The average output voltage from the cartridge is 0.25 volt. After amplification, however, 1/2-watt must be delivered to an 8-ohm loudspeaker at the output. Transformer coupling is to be used between the amplifier stages and between the output stage and the loudspeaker. To do that, we'll use the circuit shown in Fig. 1. Assume that the beta of both Q1 and Q2 is 100.

If the transformer is 60% efficient, at least 0.5/0.6 = 0.833 watt must be available from Q2. However, there are other factors such as transistor leakage, losses due to the emitter resistor, and so on. Considering those potential losses, we should be safe if we design the circuit to deliver 1 watt.

To start our design, we must first draw the load lines for output transistor Q2. When we draw the load lines, we must take into account the effect of the transformer in the collector circuit of Q2. Since the primary of the transformer is an inductor, it will present a DC resistance, equal to the resistance of the wire in the coil, but a different AC impedance. Because of that, two load lines, one DC and one AC, must be plotted on the same graph. The supply voltage is specified to be 9 volts.

Let's assume that the resistance of the primary winding of T2 is very low and just about equal to zero. We will also assume that R<sub>E2</sub> is very small and let it equal zero. Making those assumptions, the vertical line in Fig. 2 is the DC load

line. (To make the graph clearer, the transistor's characteristic curves have been omitted here.) That is, of course, determined by the equation for the load line, V<sub>CC</sub> = I<sub>C</sub>(R<sub>P</sub> + R<sub>E2</sub>) + V<sub>CE</sub>. Since R<sub>P</sub>, the resistance of the primary winding of the transformer, and R<sub>E2</sub> were both assumed to be zero, V<sub>CC</sub> = V<sub>CE</sub> for all values of collector current I<sub>C</sub>. That, of course, is the equation of a straight line.

The AC impedance is R<sub>L</sub> reflected into the primary of T2 as a resistance R<sub>L</sub>. Before we go any further, let's take another look at Q2's collector circuit because something interesting happens here. First, as we said before, the primary of the transformer is an inductor. Just as a capacitor opposes sudden changes in voltage, an inductor opposes sudden changes in current. We will show how the quiescent collector current, I<sub>CQ</sub>, is chosen shortly, but for now let's just say that it will be chosen to allow for equal swings between 0 and I<sub>Cmax</sub>. With no input signal applied to the transistor's base, I<sub>CQ</sub> (the quiescent collector current) flows through Q2's collector circuit and through the primary of T2. When an AC

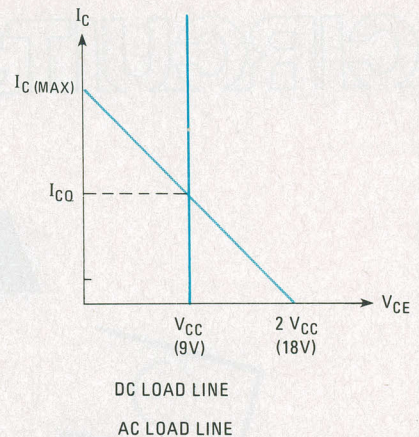


FIG. 2—THE LOAD LINES for the transistors of the circuit shown in Fig. 1 are shown here.

swing between 0 and 18 volts. Plot 18 volts on the V<sub>CE</sub> axis; that determines V<sub>Cmax</sub> on the load line.

The amount of power delivered from the transistor, 1 watt, determines the I<sub>Cmax</sub> point on the load line. Because the signal swings from the transistor's quiescent current point, I<sub>CQ</sub>, to a peak current of I<sub>Cmax</sub>, and then to a minimum current

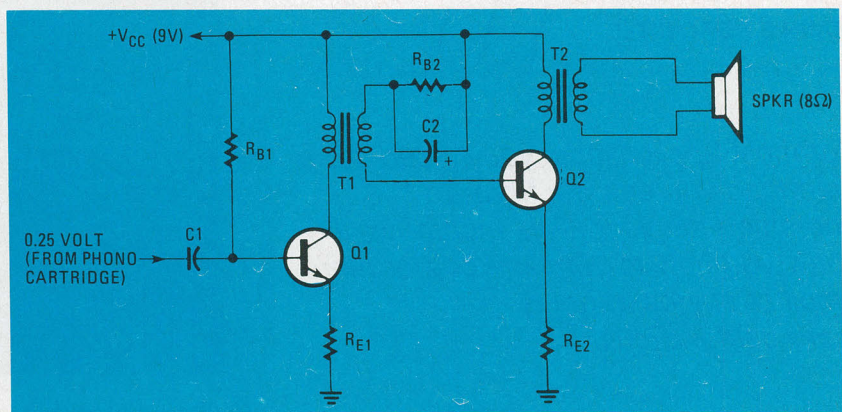


FIG. 1—THIS BASIC TRANSFORMER-COUPLED CIRCUIT uses transformers to couple the two amplifier stages, and to couple the entire circuit to the load, in this case a loudspeaker.

signal is applied to the transistor, however, things begin to change.

Let's first consider what happens when the AC-input swings negative. When that happens, the transistor tries to decrease the collector current by increasing its collector-to-emitter resistance. The inductance of T2's primary, however, opposes the change in I<sub>C</sub> and tries to maintain the flow of current at I<sub>CQ</sub>. The result is that I<sub>CQ</sub> now flows through a higher collector-to-emitter resistance, and the transistor's collector-to-emitter voltage *increases* to a level higher than the power-supply potential. That same phenomenon occurs when the input signal starts swinging positive. In that case, however, the collector-to-emitter voltage subtracts from the power-supply voltage. As a result, the transistor should be biased so that V<sub>CEQ</sub> is higher than V<sub>CC</sub>/2. We will design the circuit in Fig. 1 so that the collector-to-emitter voltage of Q2 will

of 0, the RMS current delivered by the transistor is I<sub>Cmax</sub>/2√2. Similarly, the RMS voltage due to the 0- to 18-volt swing is V<sub>Cmax</sub>/2√2 = 18/2√2 = 6.36 volts. The product of the RMS voltage and the RMS current must be equal to the required 1 watt needed from Q2, so 6.36(I<sub>Cmax</sub>/2√2) = 1, and I<sub>Cmax</sub> = 0.44 amps. Plot that point on the I<sub>C</sub> axis and draw the AC load line. Idling current, I<sub>CQ</sub>, is half of I<sub>Cmax</sub>, or 0.22 amps.

The slope of the AC load line is the negative of the load resistance as seen by Q2, or (18 - 0)/(0.44 - 0) = 41 ohms. Because the load that the loudspeaker presents to the secondary is 8 ohms, the impedance ratio of the primary to secondary is 41/8 = 5.13. The turns ratio of T2 is the square root of the impedance ratio, or 2.3:1.

For stability's sake, we want to make R<sub>E2</sub> as large as possible. But we are limited because of gain. Let us assume, for



the moment, that we can accept a gain of 8.2. Then the sum of  $R_{E2}$  and  $r_e$ , the AC emitter resistance of the transistor, can be  $41/8.2 = 5$  ohms. (That is so because the gain of a stage of amplification is equal to the ratio of the output impedance to the resistance in the emitter circuit. Here it is  $41/5 = 8.2$ .) Because the idling current is 0.22 amps, or 220 mA,  $r_e = 26/220 = 0.12$  ohms. Resistor  $R_{E2}$  can be a maximum of  $5 - 0.12 = 4.88$  ohms. Thus, a standard 4.7-ohm resistor can be used for  $R_{E2}$ . Now the actual gain of that circuit is  $41/(4.7 + 0.12) = 8.33$ . That is just a bit above our minimum desired gain of 8.2.

If the transistor is to idle at 0.22 amperes, the base current is  $I_{CQ}/\beta = 0.22/100 = 0.0022$  amp. That current is determined from the circuit consisting of  $V_{CC}$ ,  $R_{B2}$ , the resistance of the secondary of T1 (assumed to be 0 ohms), the base-emitter voltage of Q2, and the resistance  $R_{E2}$  multiplied by  $\beta$ . Knowing everything but  $R_{B2}$ , we can determine it from the equation relating all these factors,  $0.0022 = (V_{CC} - V_{BE})/(R_{B2} + \beta R_{E2}) = (9 - 0.6)/[R_{B2} + 100(4.7)]$ ; solving for  $R_{B2}$ , we find it is equal to 3348 ohms. A standard 3300-ohm resistor can be used. If that resistor is only to affect the DC bias, no signal voltage must appear across it. For that to happen,  $R_{B2}$  must be bypassed by a capacitor. The reactance of that capacitor,  $X_C$ , should be about .01 of the resistance of  $R_{E2}$ , or 330 ohms at the lowest frequency,  $f_L$ , to be amplified. The value of the required capacitor can be found from  $C = 1/(2\pi f_L X_C) = 1/2072.4 f_L$ .

Because the gain of the circuit is 8.33 and the RMS voltage at the collector of Q2 is 6.3 volts, the voltage at the secondary of T1 must be at least  $6.3/8.33$ , or 0.76 volts RMS to drive the output circuit to its desired level. The resistance across the secondary winding of T1 is the 3300 ohms of  $R_{B2}$  in parallel with  $\beta R_{E2}$  ( $r_e$  is negligible), or 3300 ohms in parallel with 470 ohms. That is equal to 411 ohms.

A reasonable load for T1 to present to the collector of Q1 is 2000 ohms. As the secondary of the transformer sees 411 ohms, and as the turns ratio of T1 is equal to the square root of the resistance ratio, that turns ratio is equal to  $\sqrt{2000/411}$ , or 2.2:1. That, of course, is also the voltage ratio. So if 0.76 volt must be across the secondary of T1 for T2 to deliver  $\frac{1}{2}$  watt,  $2.2 \times 0.76 = 1.67$  volts must be across the primary of T1. As the cartridge delivers 0.25 volt, the gain of the Q1 amplifier must be at least  $1.67/0.25 = 6.68$ . Hence  $R_{E1} + r_e$  of Q1 must be equal to or less than  $2000/6.68 = 300$  ohms. We can now plot a load line for Q1, and find its quiescent operating point, as shown in Fig. 2.

When we worked around Q2, we did not decide just what the AC load resistance should be. Now, we know it—it is 2000 ohms plus the 300-ohm resistance of the emitter, or a total of 2300 ohms. Thus,

$I_{Cmax}$  is equal to 18-volts/2300-ohms, or 7.8 mA. The quiescent operating point,  $I_{CQ}$  is one half of that for Q1, or 3.9 mA. That makes  $r_e$  for the Q1 stage equal to  $26/3.9$ , or 6.7 ohms. Resistor  $R_{E1}$  must then be a maximum of 300 ohms less 6.7 ohms, or less than 293.3 ohms. Use a standard 270-ohm resistor for that.

Since the idling collector current is 3.9 mA and  $\beta$  is 100, the base current is  $3.9/100$ , or 0.039 mA. Using that,  $R_B$  can be determined from the base current circuit; i.e.,  $(V_{CC} - V_{BE})/(R_B + \beta R_E) = (9 - 0.6)/[R_B + 100(270)]$ . Solving for  $R_B$ , it is equal to 188,000 ohms and a standard 180,000-ohm resistor can be used.

Transformer coupling is used quite often in radios where one IF stage is coupled to the other in a circuit similar to that shown in Fig. 1. In those circuits, however, a capacitor shunts the coil windings to form a resonant circuit so that only the IF frequency will pass through the amplifier circuit and all other frequencies will be rejected.

### Resistor-capacitor coupling

Transformers are fine when you are working with RF frequencies. But at AF frequencies, transformers can get quite expensive and bulky. That's why R-C coupling is now being used for many applications, although transformer-coupling is still common in RF circuits.

Let's look at the circuit shown in Fig. 3. This time, let us say that the input

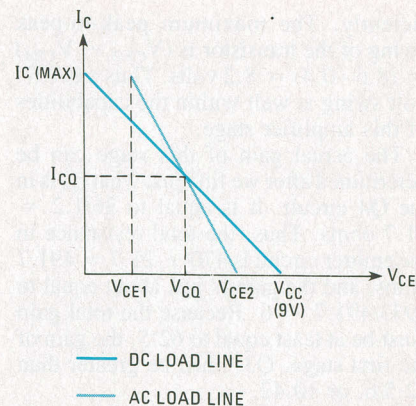


FIG. 4—THE LOAD LINES for the transistors in the circuit shown in Fig. 3.

Usually, however, the voltage gain of the second stage is made lower than that of the first stage because the output load of the second stage generally has a lower impedance.

Let's start the design by considering the second stage. Resistor  $R_{C4}$  should be chosen so that its value is between 10% to 20% of  $R_L$ ; let's make it 3300 ohms. Now the DC load on Q4 is 3300 ohms and the AC load is 3300 ohms in parallel with the 24,000 ohm load, or 2933 ohms. To have a gain of somewhat more than 5, make  $R_{E4}$  equal to about 20% of 2933 ohms, or about 470 ohms.

The DC load line (see Fig. 4) extends from  $V_{CC}$  to a point on the  $I_C$  axis equal to  $I_{Cmax}$ . From the load-line equation,  $V_{CC} = I_{Cmax}(R_{C4} + R_{E4}) + V_{CE4}$ , we find

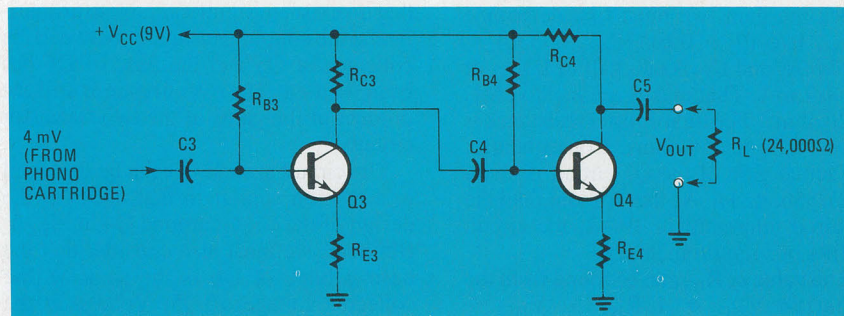


FIG. 3—AMONG THE ADVANTAGES of using R-C coupled circuits such as this one are the elimination of bulky and expensive transformers, and increased voltage gain.

signal comes from a low-impedance magnetic-type phonograph cartridge with an output of 4 millivolts. Assume we want to build that voltage up to a sufficient level to drive the power amplifier of Fig. 1. Thus the circuit in Fig. 1 would be driven by an amplifier circuit rather than by a ceramic cartridge. In this case, 0.25 volt is required at the output of the R-C circuit of Fig. 3 and that output must drive a load equal to the input impedance of the transformer amplifier, or 180,000 ohms in parallel with  $\beta$  multiplied by 276.7 ohms (the emitter resistance of Q1), or 24,000 ohms. The overall voltage gain of the amplifier must then be  $0.25\text{-volt}/4\text{-millivolt} = 62.5$ . Theoretically, the voltage gains of the two stages can be made identical. If that were done, the gain of each stage would be  $\sqrt{62.5}$ , or 7.9.

that  $I_{Cmax} = 2.4$  mA when  $V_{CE4} = 0$  and  $V_{CC} = 9$ . And, as  $I_C$  must swing between 2.4 mA and 0,  $I_{CQ} = 1.2$  mA and  $V_{CQ} = 4.5$  volts.

The AC load line must pass through that point. We can determine  $V_{CE1}$  from the negative of the equation for the slope of the AC load line, or  $(V_{CE2} - V_{CQ})/(I_{CQ} - 0) = (2933 + 470) = 3403$  ohms. Substituting  $V_{CQ} = 4.5$  volts and  $I_{CQ} = 1.2$  mA into the equation,  $V_{CE2} = 8.6$  volts. As  $V_{CE1}$  is the same distance below  $V_{CQ}$  as  $V_{CE2}$  is above it, and because  $(V_{CE2} - V_{CQ}) = (8.6 - 4.5) = 4.1$  volts, then  $V_{CE} = (4.5 - 4.1) = 0.4$  volts when  $I_C$  is equal to 2.4 mA.

The output must be able to swing the full 0.25 volt RMS, or  $2\sqrt{2}(0.25) = 0.707$  volt peak-to-peak in order to be able to drive the amplifier in Fig. 1 suf-



ficiently. The maximum peak-to-peak swing of the transistor is ( $V_{CE2} - V_{CE1}$ ) = (8.6 - 0.4) = 8.2 volts. Thus a 0.707-volt swing is well within the capabilities of this amplifier stage.

The actual gain of this stage can be determined after we find just what  $r_{e4}$  is in the Q4 circuit. It is equal to  $26/1.2 = 21.7$  ohms. Thus, the total resistance in the emitter circuit is  $470 + 21.7 = 491.7$  ohms, and the gain is just about equal to  $2933/491.7 = 6$ . Because the total gain must be at least equal to 62.5, the gain of the first stage, Q3, must be greater than 62.5/6, or 10.42.

We will now determine  $R_{B4}$  in a manner similar to that used for determining  $R_{B2}$  in the circuit of Fig. 1. Use the equation  $V_{CC} = I_B R_{B4} + V_{BE} + \beta I_B R_{E4}$ . Note that  $\beta = 100$  and  $I_B = I_{CQ}/\beta = 1.2/100 = 1.2 \times 10^{-5}$  amps. After substituting into the equation, we can calculate that  $R_{B4}$  is equal to 653,000 ohms and a standard 620,000-ohm resistor can be used.

The load on the output of the Q3 circuit is 620,000 ohms in parallel with  $\beta(R_{E4} + r_e)$ , or 45,291 ohms. As  $R_{C3}$  should be less than 10% of that, use a 4300-ohm resistor for that. Now the DC load on the transistor is 4300 ohms and the AC load is that resistor in parallel with 45,291 ohms, or 3927 ohms.

Following the procedure used to find  $R_{E4}$ , we can determine that  $R_{E3}$  should be 330 ohms if we are to get a gain of more than the required minimum of 10.42. To check the gain, we must first determine  $I_{Cmax}$ . It is  $(9 - 0.6)/(3927 + 330) = 1.97$  mA, and  $I_{CQ}$  is one-half of  $I_{Cmax}$ , or about 1 mA. That makes  $r_e$  equal to  $26/1$ , or 26 ohms. The total emitter resistance is  $330 + 26$ , or 356 ohms. Consequently, the actual gain of the Q3 circuit is about  $3927/356$ , or 11. As that is more than the required minimum of 10.42, the circuit fulfills our requirements.

The value of  $R_{B3}$  can be found from the equation  $V_{CC} = I_B R_{B3} + V_{BE} + \beta I_B R_{E3}$ . When we note that  $I_B = \beta I_{CQ}$ , we can determine that  $R_{B3}$  is equal to about 897,000 ohms, and you can use a standard 910,000-ohm resistor.

The resistance the magnetic cartridge sees is 35,600 ohms (the resistor in the emitter circuit of Q3, multiplied by the beta of that transistor) in parallel with 910,000 ohms, or just about 35,000 ohms. That is pretty close to the resistance most cartridges must see. If the resistance the cartridge must see is specified to be less than 35,000 ohms by the manufacturer, an additional shunting resistor must be wired across the cartridge. The shunting resistor can be calculated by using the equation for resistors in parallel and substituting 35,000 ohms and the resistance that the cartridge must see into the equation. Place that calculated resistor directly across the cartridge, not on the circuit side of C3. The reason it must be placed that way is to keep it from upset-

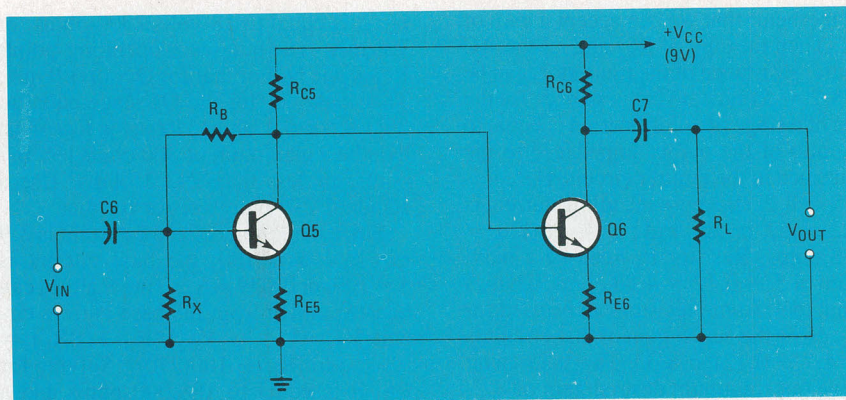


FIG. 5—DIRECT-COUPLED CIRCUIT. Those circuits have been developed to overcome the drawbacks of using capacitors as coupling devices.

ting the bias voltage established by the other components in the circuit. The function of the isolating capacitor has been detailed in the previous article on audio-amplifier circuits.

### Direct-coupled amplifiers

Using capacitors to couple transistor amplifiers does have some important drawbacks. For one thing, capacitors do not pass low frequencies very readily. Besides, capacitor-resistor circuits introduce phase shifts, are not linear, and add distortion. As a result, circuits have been developed that do not use coupling capacitors. An example of one such circuit is shown in Fig. 5. While that circuit does not appear to be much different than the one you see in Fig. 3, the differences that do exist are significant. Note primarily that the coupling capacitor between the collector of Q5 and the base of Q6 has been omitted. The overall gain is still the product of the gains of the two transistor circuits.

The circuit around Q6 can be designed in a fashion similar to that used for the design of the circuit around Q4 in Fig. 3. But here, we must also consider that the base voltage of Q6 is the same as the collector voltage of Q5. Voltage at the collector of Q5 must not be upset if Q6's base voltage is low, as it tends to be. To compensate for that, a parallel R-C network may be wired in series with  $R_{E6}$ . Considering the DC current that flows through the series resistor circuit, the DC voltage developed across the combination is much greater than it would have been had only  $R_{E6}$  been in the circuit. Voltage at the base of Q6 is the voltage across the series combination of resistors added to the  $V_{BE}$  of the transistor. The capacitor across the added series resistor is there to bypass the AC signal so that the new resistor will not affect the AC gain of Q6. The reactance of that bypass capacitor should be less than 10% of the value of the resistor it is bypassing at the lowest frequency to be amplified.

Note the  $R_B$  and  $R_X$  resistors in the base circuit of Q5. If you look back at the bias circuits described in a previous article, you will find that the circuit involving

those resistors is essential for stabilizing transistor collector-current to withstand variations of temperature. It is used here because the effect of any increase in leakage current in Q5 is multiplied in magnitude due to the DC amplification of the direct-coupled circuit. So if the leakage current in Q5 is multiplied in that transistor by a factor of 10 due to the increase in temperature, it can be multiplied further by the beta of Q6 before it appears in its collector circuit. Excellent stability is an important consideration when designing direct-coupled amplifier circuits.

More than just the collector current of Q5 flows through  $R_{C5}$ . When determining the voltage drop across that resistor, be sure to add other currents that flow through that resistor to the  $I_C$  normally expected. Bias current for Q5 flows through  $R_{C5}$  (and  $R_B$ ) along with the base bias-current for Q6. The sum of those currents may, at times, be a substantial factor in determining the quiescent conditions around the circuit, along with the expected  $I_C$ .

### Special direct-coupled circuits

Last time, we described the emitter-follower or common-collector circuit. Its characteristics were a high input impedance and a low output impedance; its power gain was equal to beta. The Darlington circuit goes one step farther and improves even on those excellent characteristics by a factor of beta.

Darlington amplifiers consist of two cascaded emitter followers, as shown in Fig. 6. If the beta of Q1 is  $\beta_1$ , and the beta of Q2 is  $\beta_2$ , the current and power gains of the overall circuit are  $\beta_1 \times \beta_2$ . But the voltage gain still remains slightly less than 1, as it did for the emitter follower.

The input impedance is  $R_E$  multiplied by the product of the betas, in parallel with  $R_B$ . The value of  $R_B$  can be quite large in that circuit as there is only a small amount of base current in Q1. That Q1 base current must equal  $(V_{CC} - 2V_{BE})/(\beta_1 \beta_2 R_E + R_B)$  for a substantial amount of emitter current to flow in Q2.

The output impedance of that circuit is  $R_B/\beta_1 \beta_2$  in parallel with  $R_E$ . The values

*continued on page 102*



## FOR ONLY \$129.95 Learn Computing From The Ground Up

Build a Computer kit that grows with you, and can expand to 64k RAM, Microsoft BASIC, Text Editor/Assembler, Word Processor, Floppy Disks and more.

### EXPLORER/85

Here's the low cost way to learn the fundamentals of computing, the all-important basics you'll need more and more as you advance in computer skills. For just \$129.95 you get the advanced-design Explorer/85 motherboard, with all the features you need to learn how to write and use programs. And it can grow into a system that is a match for any personal computer on the market. Look at these features: 8085 Central Processing Unit, the microprocessor "heart" of the Explorer/85. (Join the millions who will buy and use the 8080/8085 this year alone). Four 8-bit input/output ports from which you can input and output your programs, as well as control external switches, relays, lights, etc. a cassette interface that lets you store and reload programs you've learned to write. A deluxe 2,000 byte operating system/monitor makes it easy to learn computing in several important ways. It allows simpler, faster writing and entering of programs. It permits access by you to all parts of the system so you can check on the status of any point in the program. It allows tracing each program step by step, with provision for displaying all the contents of the CPU (registers, flags, etc.) and it does much more!

You get all this in the starting level (Level A) of the Explorer/85 for only \$129.95. Incredible! To use, just plug in your 8VDC power supply and terminal or keyboard/display — if you don't have them, see our special offers below.

□ Level A computer kit (Terminal Version) ... \$129.95 plus \$3 P&I\*

□ Level A kit (Hex Keypad/Display Version) ... \$129.95 plus \$3 P&I\*

LEVEL B — This "building block" converts the motherboard into a two-slot S100 bus (industry standard) computer. Now you can plug in any of the hundreds of S100 cards available.

□ Level B kit ... \$49.95 plus \$2 P&I\*

□ S100 bus connectors (two required) ... \$4.85 each, postpaid.

LEVEL C — Add still more computing power; this "building block" mounts directly on the motherboard and expands the S100 bus to six slots.

□ Level C kit ... \$39.95 plus \$2 P&I\*

□ S100 bus connectors (five required) ... \$4.85 each, postpaid.

LEVEL D — When you reach the point in learning that requires more memory, we offer two choices: either add 4k of a memory directly on the motherboard, or add 16k to 64k of memory by means of a single S100 card, our famous "JAWS".

Level D kit (CHECK ONE): □ 4k on-board ... \$49.95 plus \$2 P&I\* □ 16k S100 "JAWS" ... \$149.95 plus \$2 P&I\* □ 32k S100 "JAWS" ... \$199.95 plus \$2 P&I\* □ 48k S100 "JAWS" ... \$249.95 plus \$2 P&I\* □ 64k S100 "JAWS" ... \$299.95 plus \$2 P&I\*

LEVEL E — An important "building block" it activates the 8k ROM/EPROM space on the motherboard. Now just plug in our 8k Microsoft BASIC or your own custom programs.

□ Level E kit ... \$5.95 plus 50¢ P&I\*

MICROSOFT BASIC — It's the language that allows you to talk English to your computer! It is available three ways: □ 8k cassette version of Microsoft BASIC (requires Level B and 12k of RAM minimum; we suggest a 16k S100 "JAWS" — see above) ... \$64.95 plus \$2 P&I\* □ 8k ROM version of Microsoft BASIC (requires Level B & Level E and 4k RAM; just plug into your Level E sockets. We suggest either the 4k Level D RAM expansion or a 16k S100 "JAWS") ... \$99.95 plus \$2 P&I\*

□ Disk version of Microsoft BASIC (requires Level B, 32k of RAM, floppy disk controller, 8" floppy disk drive) ... \$325 postpaid.

TEXT EDITOR/ASSEMBLER — The editor/assembler is a software tool (a program) designed to simplify the task of writing programs. As your programs become longer and more complex, the assembler can save you many hours of programming time. This software includes an editor program that enters the programs you write, makes changes, and saves the programs on cassettes. The assembler performs the clerical task of translating symbolic code into the computer-readable object code. The editor/assembler program is available either in cassette or a ROM version.

□ Editor/Assembler (Cassette version; requires Level B & 8k (min.) of RAM — we suggest 16k "JAWS" — see above) ... \$59.95 plus \$2 P&I\*

□ Editor/Assembler (ROM version; supplied on an S100 card; requires Level B and 4k RAM (min.) — we suggest either Level D or 16k "JAWS") ... \$99.95 plus \$2 P&I\*

8" FLOPPY DISK — A remarkable "building block" Add our 8" floppy disk when you need faster operation, more convenient program storage, perhaps a business application, and access to the literally thousands of programs and program languages available today. You simply plug them into your Explorer/85 disk system — it accepts all IBM-formatted CP/M programs.

□ 8" Floppy Disk Drive ... \$499.95 plus \$12 P&I\*

□ Floppy Controller Card ... \$199.95 plus \$2 P&I\*

□ Disk Drive Cabinet & Power Supply ... \$69.95 plus \$3 P&I\*

□ Drive Cables (set up for two drives) ... \$25.00 plus \$1.50 P&I\*

□ CP/M 2.2 Disk Operating System: includes Text Editor/Assembler, dynamic debugger, and other features that give your Explorer/85 access to thousands of existing CP/M-based programs ... \$150.00 postpaid.

NEED A POWER SUPPLY? Consider our AP-1. It can supply all the power you need for a fully expanded Explorer/85 (note: disk drives have their own power supply). Plus the AP-1 fits neatly into the attractive Explorer steel cabinet (see below).

□ AP-1 Power Supply kit (8V @ 5 amps) in deluxe steel cabinet ... \$39.95 plus \$2 P&I\*

NEED A TERMINAL? We offer you choices: the least expensive one is our Hex Keypad/Display kit that displays the information on a calculator-type screen. The other choice is our ASCII Keyboard/Computer Terminal kit, that can be used with either



1. Plug in Netronics's Hex Keypad/Display
2. Add Level B to convert to S100
3. Add 4k RAM
4. Plug in Level E here: our Hex Keypad/Display or Editor/Assembler in ROM
5. Add two S100 boards
6. Add your own custom circuits (prototyping area)
7. Connect terminal

a CRT monitor or a TV set (if you have an RF modulator)  
□ Hex Keypad/Display kit ... \$69.95 plus \$2 P&I\*

□ FASTERM - 64 TERMINAL KIT — Featuring a 56 key ASCII Keyboard, 128 character set upper and lower case, 75 ohm output, 8 baud rates: 150 to 19,200 (switch selectable), RS232C or 20 MA output, 32 or 64 character by 16 line formats, complete with Deluxe Steel Cabinet and Power Supply ... \$199.95 plus \$3 P&I\*

□ RF Modulator kit (allows you to use your TV set as a monitor) ... \$4.95 postpaid

□ 12" Video Monitor (10MHz bandwidth) ... \$139.95 plus \$5 P&I\*

□ Deluxe Steel Cabinet for the Explorer/85 ... \$49.95 plus \$3 P&I\*

□ Fan for cabinet ... \$15.00 plus \$1.50 P&I\*

### ORDER A SPECIAL-PRICE EXPLORER/85 PAK — THERE'S ONE FOR EVERY NEED.

□ Beginner Pak (Save \$26.00) — You get Level A (Terminal Version) with Monitor Scope Listing (\$25 value) AP-1, 5-amp. power supply, Intel 8085 Users Manual ... (Reg. \$199.95) SPECIAL \$169.95 plus \$4 P&I\*

□ Experimenter Pak (Save \$53.40) — You get Level A (Hex Keypad/Display Version) with Hex Keypad/Display, Intel 8085 User Manual, Level A Hex Monitor Scope Listing, and AP-1 5-amp. power supply ... (Reg. \$279.95) SPECIAL \$219.95 plus \$6 P&I\*

□ Special Microsoft BASIC Pak (Save \$103.00) — You get Levels A (Terminal Version), B, D (4k RAM), E, 8k Microsoft in ROM, Intel 8085 User Manual, Level A Monitor Scope Listing, and AP-1 5-amp. power supply ... (Reg. \$499.70) SPECIAL \$399.95 plus \$7 P&I\*

□ Complete 64K System (Requires Levels B and D or S100 Memory) ... \$59.95 plus \$2 P&I\*

Starter 8" Disk System — Includes Level A, B floppy disk controller, one CDC 8" disk-drive, two-drive cable, two S100 connectors; just add your own power supplies, cabinets and hardware ... (Reg. \$1065.00) SPECIAL \$999.95 plus \$13 P&I\*

□ 32k Starter System, \$1045.95 plus \$13 P&I\* □ 48k Starter System, \$1085.95 plus \$13 P&I\* □ 64k Starter System, \$1145.95 plus \$13 P&I\*

□ Add to any of above Explorer steel cabinet, AP-1 five amp. power supply, Level C with two S100 connectors, disk drive cabinet and power supply, two sub-D connectors for connecting your printer and terminal ... (Reg. \$225.95) SPECIAL \$199.95 plus \$13 P&I\*

□ Complete 64K System Wired & Tested ... \$1650.00 plus \$26 P&I\*

□ Special! Complete Business Software Pak (Save \$625.00) — Includes CP/M 2.2 Microsoft BASIC, General Ledger, Accounts Receivable, Accounts Payable, Payroll Package ... (Reg. \$1325) SPECIAL \$699.95 postpaid.

\*P&I stands for "postage & insurance." For Canadian orders, double this amount.

Continental Credit Card Buyers Outside Connecticut:

**TO ORDER**  
**Call Toll Free:**  
**800-243-7428**

**To Order From Connecticut, or For Technical Assistance, Call (203) 354-9375**

CP/M is a reg. trademark of Digital Research

★ (Clip and mail entire ad) ★

SEND ME THE ITEMS CHECKED ABOVE

Total Enclosed (Conn. Residents add sales tax): \$

Pay by:

□ Personal Check □ Cashier's Check/Money Order

□ VISA □ MASTER CARD (Bank No. \_\_\_\_\_)

Acct. No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Signature \_\_\_\_\_

Print Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

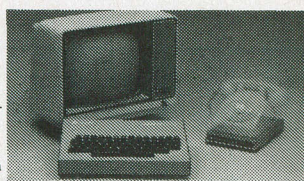
Zip \_\_\_\_\_

**NETRONICS Research & Development Ltd.**  
333 Litchfield Road, New Milford, CT 06776

## ANNOUNCING TWO NEW TERMINALS

Smart • Fast • Graphics • Matching Modem and \$295 Printer

Netronics announces a state of the art breakthrough in terminals, now at prices you can afford, you can go on-line with data-bank and computer phone-line services. It's all yours: "electronic newspapers," educational services, Dow-Jones stock reports, games, recipes, personal computing with any level language, program exchanges, electronic bulletin boards ... and more every day!!!



Netronics offers two new terminals, both feature a full 56 key/128 character typewriter-style keyboard, baud rates to 19.2 kilobaud, a rugged steel cabinet and power supply. The simplest one, FASTERM-64, is a 16 line by 64 or 32 character per line unit, with a serial printer port for making hard copy of all incoming data, and optional provisions for block and special character graphics. The "smart" version, SMARTERM-80, features either 24 line by 80 characters per line or 16 by 40 characters per line, it offers on-screen editing with page-at-a-time printing, 12,000 pixel graphics, line graphics, absolute cursor addressing, underlining, reverse video, one-half intensity and much more ... simply plug them into your computer or our smart modem and be on-line instantly. Use your TV set (RF modulator required) or our deluxe green-phosphor monitor pictured above. For hard copy just add our matched printer.

Price breakthrough!!! Own the FASTERM-64, a complete terminal kit, ready to plug in for just \$199.95 or order the SMARTERM-80 kit for just \$299.95, (both available wired and tested). Be on-line with the million-dollar computers and data services today ... we even supply the necessary subscription forms.

More good news: All the components in our terminals are available separately (see coupon), so you buy only what you need!!!

**FASTERM-64** ... DISPLAY FORMAT: 64 or 32 characters/line by 16 lines ... 96 displayable ASCII characters (upper & lower case) ... 8 baud rates: 150, 300, 600, 1200, 2400, 4800, 9600, 19,200 (switch sel.) ... LINE OUTPUT: RS232C or 20 ma current loop ... VIDEO OUTPUT: 1V P/P (EIA RS-170) ... CURSOR MODES: home & clear screen, erase to end of line, erase cursor line, cursor up & down, auto carriage return/line feed at end of line & auto scrolling ... REVERSE VIDEO ... BLINKING CURSOR ... PARITY: off, even or odd ... STOP BITS: 1, 1.5, 2 ... DATA BITS PER CHARACTER: 5, 6, 7 or 8 ... CHARACTER OUTPUT: 5 by 7 dot matrix in a 7 by 12 cell ... PRINTER OUTPUT: prints all incoming data ... 1K ON BOARD RAM ... 2K ON BOARD ROM ... COMPLETE WITH POWER SUPPLY ... OPTIONAL GRAPHICS MODE: includes 34 Greek & math characters plus 30 special graphics characters ... ASCII ENCODED KEYBOARD: 56 key/128 characters.

**SMARTERM-80** ... DISPLAY FORMAT: 80 characters by 24 lines or 40 characters by 16 lines 128 displayable ASCII characters (upper & lower case) 8 baud rates: 110, 300, 600, 1200, 2400, 4800, 9600, 19,200 ... LINE OUTPUT: RS232C or 20 ma current loop ... VIDEO OUTPUT: 1V P/P (EIA RS-170) ... INSERT/DELETE FEATURES: insert/delete line, insert/delete character, forward/back tab ... LINE OR PAGE TRANSMIT ... PAGE PRINT FUNCTION ... CURSOR POSITIONING: up, down, right, left, plus absolute cursor positioning with read back ... VISUAL ATTRIBUTES: underline, blink, reverse video, half intensity, & blank ... GRAPHICS: 12,000 pixel resolution block plus line graphics ... ON-SCREEN PARITY INDICATOR ... PARITY: off, even or odd ... STOP BITS: 110 baud 2, all others 1 ... CHAR. OUTPUT: 7 by 11 character in a 9 by 12 cell ... PRINTER OUTPUT: 60 OR 50 HZ VERTICAL REFRESH ... BLINKING BLOCK CURSOR ... CRYSTAL CONTROLLED ... 2K ON BOARD RAM ... ASCII ENCODED KEYBOARD: 56 key/128 character ... 4K ON BOARD ROM ... COMPLETE WITH POWER SUPPLY.

**TELEPHONE MODEM 103 O/A** ... FULL DUPLEX, FCC APPROVED ... DATA RATE: 300 baud ... INTERFACE: RS232C and TTY ... CONTROLS: talk/data switch (no need to connect and disconnect phone), originate/answer switch on rear panel ... NO POWER SUPPLY REQUIRED.

**ASCII KEYBOARD ASCII-3** ... 56 KEY/128 CHARACTER ASCII ENCODED ... UPPER & LOWER CASE ... FULLY DEBOUNDED ... 2 KEY ROLL-OVER ... POS OR NEG LOGIC WITH POS STROBE ... REQUIRES +5 & -12V DC (SUPPLIED FROM VIDEO BOARDS) ... **PRINTER COMET I** ... SERIAL I/O TO 9600 BAUD ... 80 CHARACTER COLUMN (132 COMPRESSED) ... 10" TRACTOR FEED ... UPPER/LOWER CASE ... INDUSTRY STANDARD RIBBONS ... 4 CHARACTER SIZES ... 9 BY 7 DOT MATRIX ... BI-DIRECTIONAL PRINTING



Continental U.S.A. Credit Card Buyers Outside Connecticut  
**CALL TOLL FREE 800-243-7428**

To Order From Connecticut Or For Tech. Assist. Call (203) 354-9375

**NETRONICS R&D LTD. Dept.**  
**333 Litchfield Road, New Milford, CT 06776**

Please send the items checked below:

□ COMPLETE FASTERM-64 TERMINAL (includes FASTVID-64 video board ASCII-3 keyboard, steel cabinet and power supply) ... kit \$199.95 plus \$3 P&I ... wired & tested \$249.95 plus \$3 P&I ... graphics option: add \$19.95 to each of above

□ COMPLETE SMARTERM-80 TERMINAL (includes SMARTVID-80 video board, ASCII-3 keyboard, steel cabinet and power supply) ... kit \$299.95 plus \$3 P&I ... wired and tested \$369.95 plus \$3 P&I

□ FASTVID-64 VIDEO BOARD (requires +5 & -12V DC) ... kit \$99.95 plus \$3 P&I ... graphics option add \$19.95 ... wired & tested \$129.95 plus \$3 P&I ... graphics option add \$19.95

□ SMARTVID-80 VIDEO BOARD (requires +5 & -12V DC) ... kit \$199.95 plus \$3 P&I ... wired & tested \$249.95 plus \$3 P&I

□ DELUXE STEEL TERMINAL CABINET ... \$19.95 plus \$3 P&I

□ ASCII-3 KEYBOARD (requires +5 & -12VDC) ... kit \$69.95 plus \$3 P&I ... wired and tested \$89.95 plus \$3 P&I

□ POWER SUPPLY (powers ASCII-3 keyboard & video boards) ... kit only \$19.95 plus \$2 P&I

□ ZENITH VIDEO MONITOR (high resolution green phosphor) ... wired & tested \$149.95 plus \$6 P&I

□ TELEPHONE MODEM MODEL 103 O/A ... wired & tested \$189.95 plus \$3 P&I

□ DOT MATRIX PRINTER Comet I ... wired & tested \$299.95 plus \$10 P&I

□ RF MODULATOR MOD RF-1 ... kit only \$8.95 plus \$1 P&I

□ 3FT-25 LEAD MODEM/TERMINAL OR PRINTER/TERMINAL CONNECTOR CABLE ... \$14.95 ea plus \$2 P&I

For Canadian orders, double the postage. Conn. res. add sales tax.

Total Enclosed \$

□ Personal Check □ Cashier's Check/Money Order

□ VISA □ MasterCard (Bank No. \_\_\_\_\_)

Acct. No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Signature \_\_\_\_\_

Print Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Zip \_\_\_\_\_



# COMPUTER CORNER

## Selecting an accounting package

LES SPINDLE\*

OFFICE AUTOMATION PERFORMS A VARIETY of useful functions that can greatly increase the cost-effectiveness of each employee. In previous columns, we have examined such sophisticated business-software innovations as database management systems (DBMS) and financial-planning programs (like *VisiCalc*). Those state-of-the-art programs offer creative solutions to everyday office problems. Perhaps less ostentatious—but no less useful—are the software packages available for everyday bookkeeping tasks, one of which is shown in Fig. 1.

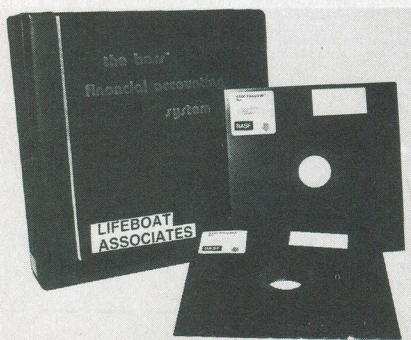


FIG. 1

General ledger, accounts payable, accounts receivable, inventory, and payroll form what are commonly referred to as the "Big 5" accounting programs. The bookkeeper who works with quality programs in each of those categories—or opts for a complete interactive "Big 5" package—will benefit from greatly increased productivity from his accounting staff.

Careful planning and selective shopping—as always—are the keys to finding the software that will be best suited to your purposes. It is important to select software that offers enough features and options to make the conversion of your bookkeeping records relatively simple. At the same time, it is wise to select packages that allow enough flexibility for you to fine-tune the program to your own special requirements. Let's take a look at a few criteria to keep in mind when choosing various accounting programs for your office.

In planning to computerize your general-ledger system, begin by defining your needs. Can that system operate in-

dependently, or is it preferable to have one that interacts with other "Big-5" programs? Will it be restricted to the financial activities of one office, or must the reports from various branch offices or subsidiaries be integrated as well? What is the volume of transactions? It is important that your computer system have the memory capacity to support the necessary functions. How educated is your office staff in computer functions? That is important in choosing between a general-ledger package that uses a step-by-step format to guide the novice user through the program, or a more sophisticated offering.

It is important to chart out all of your requirements before even beginning to shop. The salesman demonstrating the software will only be able to direct you to the package best suited to your purposes if he has a good idea of the quantity of data that has to be processed and the specific requirements of your bookkeeping methods.

A general ledger is essentially a financial history of a specific accounting period that lets management analyze a company's profile to determine appropriate planning strategies. The primary functions are to keep a record of financial transactions and the resulting balances, and to generate regular balance-sheets and profit/loss statements.

It is vital for a general-ledger program to use a double-entry accounting system. (That means that for every dollar of debit, there is a corresponding credit entry of equal amount, and vice versa.) Double-entry bookkeeping is a safeguard to insure that all accounts are in balance.

Another point to look for is the system's ability to set up a proper chart of accounts. That is a crucial part of the general-ledger framework, for it can provide rapid departmental profiles, as well as a perspective on the financial status of the entire company. Since the allowable number of accounts varies from package to package, the prospective buyer should select a package that can handle the current number of accounts, and is flexible enough to expand as the company does.

### Accounts payable/receivable

An accounts-payable or -receivable package has five primary functions. It must: create master files for customers

and vendors; record sales and purchases; index all sales/purchase data with the appropriate master files; manipulate the data, and prepare summary reports by master file account, date, or some other reference.

As with general-ledger programs, your particular needs will determine the appropriate checklist of required features that you should prepare.

One of the important criteria is the ability to produce audit trails—especially for companies that require a certified audit. A good program will automatically prepare a transaction listing immediately after the data is input.

Most accounts-payable systems will require more detailed record-keeping. For example, a check may have to be coded to multiple accounts (for example, when a single check pays a bill that covers different accounts).

Job-costing is another important feature, as many manufacturers will need to access accumulated costs by job. An accounts-payable system set up to handle job-costing can accept job codes as well as account numbers.

Among other items to keep in mind are: commission accounting (some companies don't pay commissions to the salesman until after the company is paid) and finance charges. The better accounting packages are able to compute and assign finance charges rapidly and efficiently. Most accounts-receivable systems will print statements and invoices, and good ones will automatically print checks—both functions are useful and time-saving for the accountant.

### Inventory control

There are several benefits in managing the flow of merchandise to be gained from an inventory-control program. Overstocks can be reduced and out-of-stock situations can be avoided. The average small business pays 25–50% of the value of its inventory just in inventory carrying-costs.

The two most common approaches to automating inventory control are invoicing and order entry. With the invoicing approach, the program won't accept invoicing data until after the order is filled—generating an invoice only upon completion of the order. That system has the drawback of not being able to list

\*Managing Editor, *Interface Age* magazine



# Interested in the IBM Personal Computer?



**I**f you're interested in the IBM Personal Computer then you need PC magazine. PC magazine is the Independent Guide to IBM Personal Computers. Each issue is packed with information for everyone interested in IBM Personal Computers.

PC magazine tells you how to put together the best IBM "PC" system and then how to get the most out of it. Each issue brings you hundreds of colorful pages of evaluations, insights, and straight talk from respected experts—professionals in computer science as well as writers, businessmen, lawyers, educators, and many others.

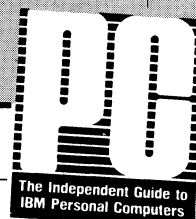
PC covers software, hardware, applications and most every topic of importance to the thousands of IBM Personal Computer users who read it. To ensure that we give you the information you need, PC includes a special "User-to-User" section, as well as a "PC Wish List", and news about IBM Personal

Computer clubs, events and publications.

For a limited time, you can subscribe to PC at NO RISK and still receive a 25% discount off the newsstand price. Enter your subscription

now. If not fully satisfied when you receive your first copy of PC, simply return your mailing label within 15 days for a full refund.

**This is the  
magazine  
that tells you  
all about it.**



Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

☐ 6 issues/\$14.50    ☐ 12 issues/\$27.00    ☐ 24 issues/\$46.00  
☐ Check enclosed    ☐ VISA    ☐ MasterCard    ☐ Bill me  
Card # \_\_\_\_\_ expires \_\_\_\_\_

☐ I already own an IBM "PC"    ☐ I am thinking about buying one

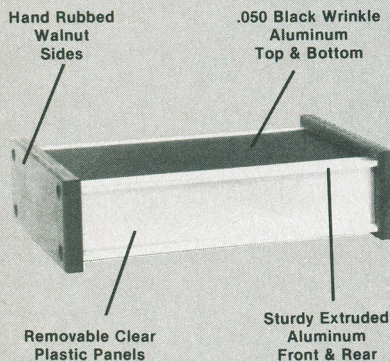
**Dept. RE10,**  
PC Magazine  
1528 Irving St.,  
S.F., CA 94122

**Phone Credit Card Orders to:**  
(Toll Free Number)  
California: 800/792-0990, ext. 1136  
All Other States: 800/227-3800, ext. 1136

RE12



## ENCLOSURES CUSTOM & STOCK



### BEAUTIFUL ELECTRONIC CABINETS

Stock No.	Inside Dimensions	Price
EA2-020805	1 1/4" H x 8-1/8" W x 5-1/8" D	\$18.54
EA2-021209	1 1/4" H x 12" W x 9" D	\$24.90
EA3-030805	2 3/4" H x 8-1/8" W x 5-1/8" D	\$22.27
EA3-031209	2 3/4" H x 12" W x 9" D	\$30.97

TO ORDER: Enclose Check, MasterCard or VISA No. Add \$3.00 Shipping & Handling. Contact the Factory for quantity pricing, custom enclosures, and our full line catalog. Distributors and O.E.M. inquiries welcome.

**RHODES**  
NATIONAL CORPORATION

FABTRON Div.  
P.O. Box 925  
Columbia, TN 38401  
Phone: (615) 381-1143

CIRCLE 94 ON FREE INFORMATION CARD

backorders and open-orders.

An order-entry system will accept the data at any time, separating order-placement and invoicing into two different steps. Also, open-orders may be altered in any way called for, prior to billing. Most businesses will benefit from that approach, as opposed to the more limiting invoicing setup.

An obvious, but critical, consideration in the selection process is knowing the system's ability to handle the current volume of items—as well as knowing its capability for coping with future growth. That often involves hardware decisions such as whether your disk capacity is sufficient to handle the data involved. Most inventory packages on the market will handle at least 1000 items of stock, which should be adequate for most small businesses.

The allowable size of data fields is also very important. Basic specifications for items in stock must be supplemented with other information. Make sure that the package you select allows for that. Such data as product class or code, average cost, previous cost, and product description are often required, so your data fields must be structured with enough space to enter the necessary information.

### Payroll

A payroll system is set up primarily to compute and print payroll checks, distrib-

ute labor costs to the proper files, and compile the information required for government reports.

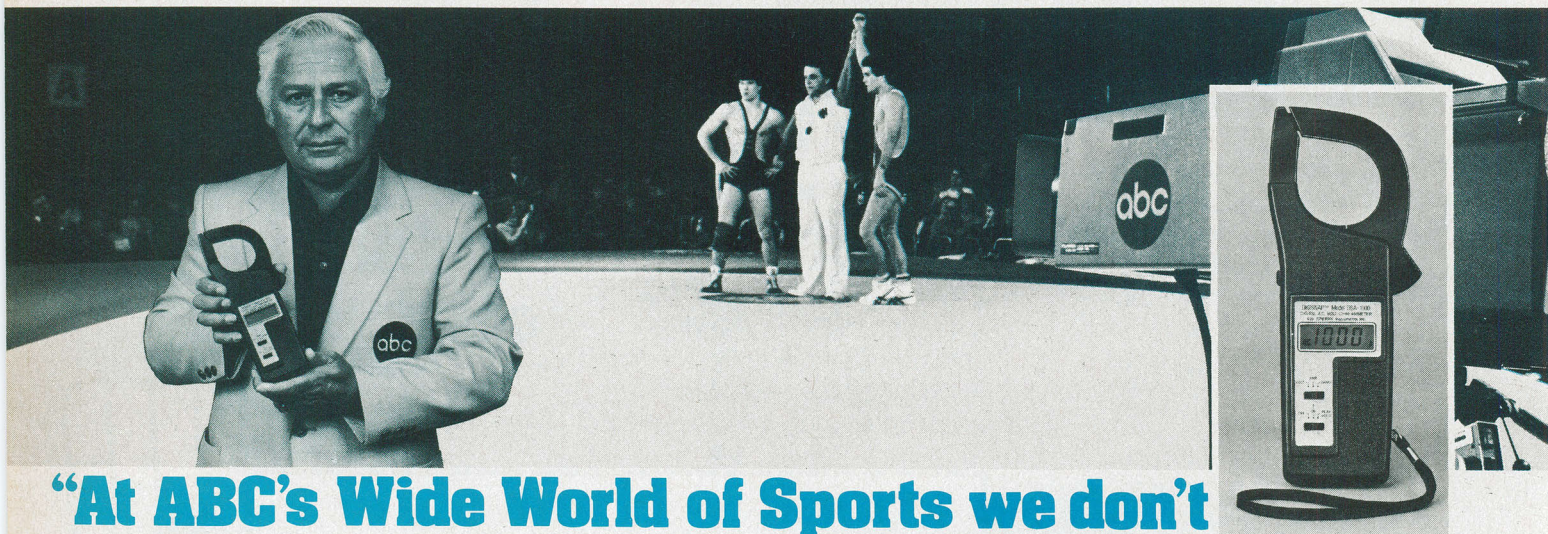
The most common features one can expect in a package are: computing FICA, state unemployment, and federal and state taxes; reporting of employee earnings by category (such as department); generating quarterly and annual government tax filings; and handling of miscellaneous items (non-taxable items, overtime pay, savings and dental plans.)

There are a myriad of other features to be found in various accounting packages. Among them are: reports on hours worked as well as dollar amounts by department and job; union reports; earnings history for each employee; employee files (hire, review, and termination dates), and data on earned-income credits.

More than any other accounting program, a good payroll program can save weeks of employee labor per year. But because of the confidentiality, timeliness, and accuracy required, choosing the right one is an especially crucial step in putting together a computerized bookkeeping system.

Sample the brochures from many different vendors and ask as many questions as you have to satisfy yourself before deciding which package has the features that will work best in your accounting organization.

R-E



## "At ABC's Wide World of Sports we don't play games. We use the AWS Digisnap.™"

"As everyone knows, ABC's Wide World of Sports does the finest job of covering sporting events for television. The explanation is simple: Demand for total perfection. Cameras, lighting and sound equipment must always be operating at peak performance. All electrical and electronic hook-ups are checked and re-checked. And if a problem should occur, it must be found and corrected - fast. That's why ABC technicians rely on the AWS Digisnap digital snap-around volt-ohmmeter for their electrical testing needs. Its autoranging feature saves them valuable time and its readings are consistently reliable and accurate."

### Outstanding features include:

- Autoranging.
- Large, 3 1/2 digit LCD.
- 75,000 hour/rated rechargeable battery life.
- Up to 75 hours continued use between charges.
- Peak detector measures current & voltage surges.
- Overload protection on all ranges.
- Tear-drop shape jaw design for working in tight areas.
- Electronic data lock to freeze reading.
- Housed in shock-resistant ABS plastic.

William Stone,  
Technical Manager, ABC-TV

For more information on the Digisnap Model DSA-1000, or any of the other fine AWS instruments, call your distributor today or contact A.W. Sperry Instruments Inc., P.O. Box 9300, Smithtown, N.Y. 11787 • 800-645-5398 Toll-Free (N.Y., Hawaii, Alaska call collect 516-231-7050).

**A.W. SPERRY  
INSTRUMENTS INC.**  
The Measurable Advantage.

"See Us At Midcon '82 - Booth #620"

CIRCLE 93 ON FREE INFORMATION CARD



# Introducing the first State-of-the-Art Cordless Phone Viking II

**The only cordless extension phone with true Touch Tone® dialing that works anywhere inside or outside your home... up to 800 feet away.**

Imagine being able to make or receive phone calls from anywhere you may be, in or around your home. In the kitchen, den, bedrooms or bath. And outside too! On the patio, by the pool, out in the garden...or even walking your dog. Anywhere and everywhere up to 800 feet - with no wires or long extension cords...AND no monthly rental charges.

The all new VIKING II has been designed and engineered in California's famous "Silicon Valley" to bring the most advanced space-age telephone capabilities right into your own home. And now it can be yours for a 15 day free trial. Use it and see for yourself. If you are not completely satisfied with its remarkable performance, just send it back and receive a full refund of the low purchase price of just **\$149.95.**

## So Easy To Use

The VIKING II looks and works just like the most modern extension phones. Only it has no cord at all! It's an attractive, lightweight instrument that is very comfortable to use...and easy to take with you as you move from place to place around your home.

It comes complete with a small contemporary design Base Unit which you simply plug into a phone jack and any AC current outlet. The remote cordless phone is "connected" to the Base Unit by two channels of hi-fi FM radio, as authorized by the FCC. The portable handset operates on batteries, which can be recharged with its own charger at any AC outlet. Unlike most cordless phones, the VIKING II does not have to be plugged into the Base Unit for recharging. And there is even a small red light to remind you when it's time to charge.

## Compare It With Other Cordless Phones

The VIKING II easily outperforms competitive units costing up to twice as much. Unlike most cordless phones on the market, it doesn't look or work like a CB "walkie-talkie." The VIKING II incorporates full "duplex" operation, which lets you talk and listen just as you do with your regular phone. There are no buttons to push to talk and there's no "roger, over and out" nonsense. It operates loud and clear at distances up to 800 feet from its Base Unit...more than twice the range of many units. And it comes with a limited warranty...for a full 90 days.



## The Perfect Extension Phone

With the VIKING II you can now have an extension phone right at your side wherever you may be in or around your house.

Simply take it with you as you move from place to place and your calls will come right to you. No more running for the phone, no more long extension cords or extra jacks. And best of all, no monthly rental charges from the phone company. For privacy, a special built-in system of sub-audible tones and the use of multiple frequencies prevents any other portable units from gaining access to your line.

To order, just send check or money order for **\$149.95**, plus \$5.95 shipping and handling, to Viking Phone Company. (California residents add 6½% sales tax.) Master Charge or VISA credit card users may order by phone.

## JUST \$149.95

Far less than competitive units that don't begin to equal VIKING II performance

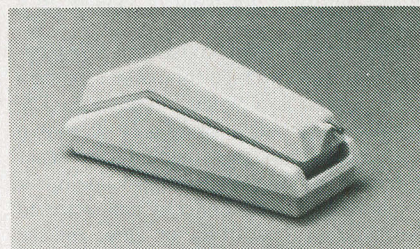


## True Touch-Tone Dialing

The VIKING II operates with a true Touch Tone key-board...not the push button pulse-dialers found on other units. This means you can use all the special telephone services available to Touch Tone phones, even if your present phone is a conventional rotary dial model. Banking and bill paying by phone and the economical long distance services of SPRINT and MCI are just a few of the conveniences which can be yours with your VIKING II.

**Call Toll Free  
800-227-9754**

**in California call collect  
415-941-6942**



# Viking

Phone Company  
450 First Street (Box 689)  
Los Altos, CA 94022

Touch Tone is a registered trademark of AT&T.

**CIRCLE 96 ON FREE INFORMATION CARD**



# NEW IDEAS

## Low-battery indicator

TODAY MANY HOBBYISTS BUILD BATTERY-operated projects using highly efficient solid-state devices that ensure long battery-life. Even with those circuits, though, a need occasionally arises to make certain that the battery—which may have been in use for some time—is still in good condition. I use the low-battery indicator shown in Fig. 1 in several battery-powered special-effects devices for the theater, where it is crucial that everything operate when it's supposed to.

is selected by the potentiometer; the device can be adjusted most easily by applying to it the voltage at which you want the LED to turn on and adjusting the potentiometer until it just does so.

The indicator uses only six parts: R1 is 27K; R2 is a 100K linear potentiometer; R3 is 1K, and Zener diode D1 is rated at 6.2 volts; IC1 is a 741, and just about any LED will work. The device is easy to build and doesn't present much of a load to the battery it monitors—the version I use draws only

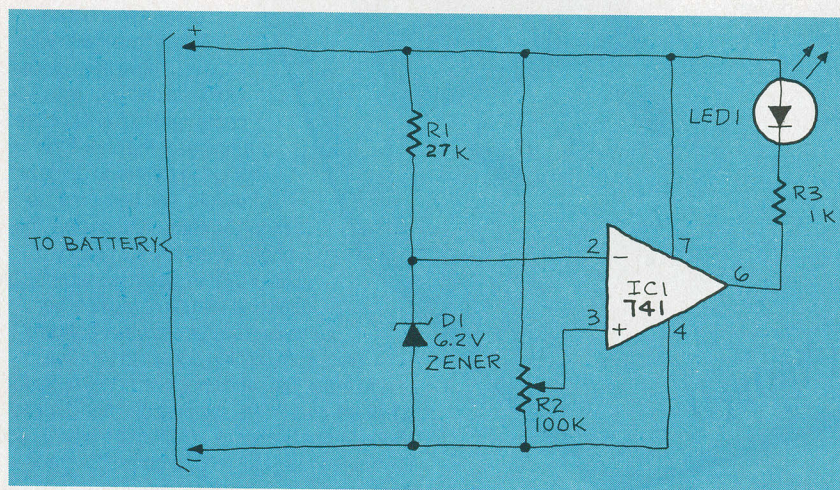


FIG. 1

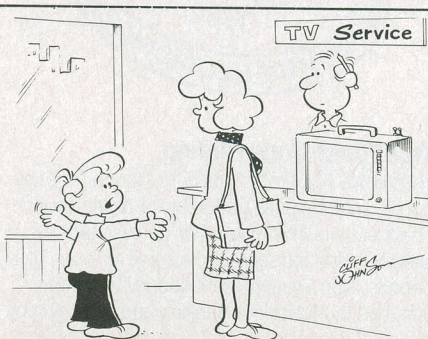
The low-battery indicator uses an LED to signal when the battery voltage has dropped below a pre-selected level. It is easy to build, reliable, and inexpensive, and can be adapted for a wide range of voltages. The device shown is intended to operate in a 9-volt circuit.

The sensing circuit consists of a 741 op-amp set up as a voltage comparator, using a Zener diode as a voltage reference. The op-amp is inserted as a bridge between two resistance ladders, one containing the Zener reference, and the other a high-value linear potentiometer. The Zener is connected to the inverting input of the op-amp, and the wiper of the potentiometer is connected to the non-inverting input. The top and bottom of the bridge are connected to  $V_{CC}$  and ground, respectively.

When the voltage at the wiper of the potentiometer drops below the voltage set by the Zener, the output of the op-amp goes low; that turns on the LED connected between it and  $V_{CC}$ . The LED turn-on voltage

about one milliamp when idling, and about 20 milliamps when the LED is lit.

The circuit can be adapted to work with battery-powered circuits requiring between 6 and 18 volts; the only changes needed would be a lower-voltage Zener and smaller current-limiting resistor in the case of voltages below nine volts, and a larger resistor for higher voltages.—Donald F. Ricklies

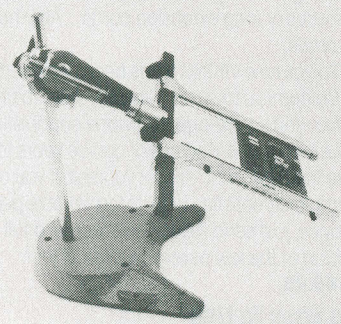


"But, Mom, I liked the green faces—they were scary."

## NEW IDEAS

This column is devoted to new ideas, circuits, device applications, construction techniques, helpful hints, etc.

All published entries, upon publication, will earn \$25. In addition, Panavise will donate their model 333—The Rapid Assembly Circuit Board Holder, having a retail price of \$39.95. It features an eight-position rotating adjustment, indexing at 45-degree increments, and six positive lock positions in the vertical plane, giving you a full ten-inch height adjustment for comfortable working. (See photo below.)



I agree to the above terms, and grant **Radio-Electronics** Magazine the right to publish my idea and to subsequently republish my idea in collections or compilations of reprints of similar articles. I declare that the attached idea is my own original material and that its publication does not violate any other copyright. I also declare that this material had not been previously published.

Title of Idea

Signature

Print Name

Date

Street

City

State

Zip

Mail your idea along with this coupon to: **New Ideas Radio-Electronics**, 200 Park Ave. South, New York, NY 10003



# NEW LIT

For more details use the free information card inside the back cover

**MICROCOMPUTER GAMES**, is a color 2-page letter-sized flyer describing 19 computer games. The games range from solitaire layouts (Voyager, Computer Football Strategy, Controller), 1 - 4 players (Computer Stocks and Bonds), 2 - 4 players (Computer Foreign Exchange), up to as many as 20 players seeking to conquer the universe (Galaxy). Free from **The Avalon Hill Game Company**, 4517 Hartford Road, Baltimore, MD 21214.

**CIRCLE 111 ON FREE INFORMATION CARD**

**HEX-TOOL CATALOG**, No. SD-267, is 4-color, 8 pages, and contains complete descriptions and photographs of Vaco's newly expanded line of unique ball-end hex tools.

Included is an expanded line of "L" style ball-end hex keys in both inch and metric measure, a brand new line of inch and metric ball-end drivers, and new ball-end hex key caddy sets.

The catalog also illustrates the unique features and benefits of Vaco's ball-end hex tools. They allow easy access even in restricted or hard-to-reach areas, set or remove screws at angles up to 30°, and drive fasteners quicker and easier, saving time and labor. The No. SD-267 Ball End Hex Tool Catalog is free upon request from **Vaco Products Company**, 1510 Skokie Blvd., Northbrook, IL 60062.

**CIRCLE 112 ON FREE INFORMATION CARD**

**TV/VIDEO SYNC**, Primer and Product Note Opt. 005-1 is a 16-page primer, with 13 drawings and 3 photographs; the special sections include the United States NTSC broadcast standards and nomenclature, a discussion of PAL and SECAM systems of color transmissions, and a glossary of TV and video terms.

Other sections cover theory of operation, typical setup, specifications, and the features and applications possible when a TV/video

sync option is added to any currently-manufactured **HP 1700-series** oscilloscope. Applications described are relevant to such industries as medical imaging, consumer video products, and television broadcasting.

Copes are free from **Hewlett-Packard**, Inquiries Manager, 1820 Embarcadero Road, Palo Alto, CA 94303.

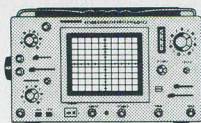
**CIRCLE 113 ON FREE INFORMATION CARD**

**ELECTRONICS BROCHURE** details a complete product line that includes more than 55,000 varieties of electron tubes, integrated circuits, semiconductors, connectors, and components. Eimac, RCA, Philips ECG, and General Electric are just a few of the high-quality lines of transmitting, receiving, and industrial tubes and semiconductors that are listed. The brochure is available free from **Alpha Electronics, Inc.**, 1365 39th St., Brooklyn, NY 11218.

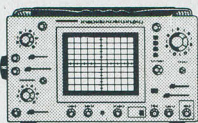
**R-E**  
**CIRCLE 114 ON FREE INFORMATION CARD**

## 6 NEW LEADER OSCILLOSCOPES at FORDHAM PRICING.

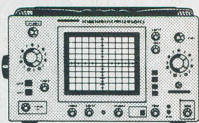
New Features • Immediate Delivery • 2-Year Warranty.



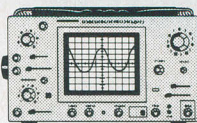
35-MHZ  
Dual Trace/  
Dual Time Base  
LBO-524



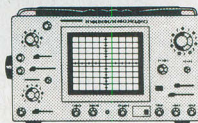
35-MHZ  
Dual Trace/  
Dual Time Base  
LBO-524L  
(with signal delay)



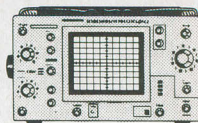
35-MHZ  
LBO-523



20-MHZ  
Dual Trace  
LBO-522



15-MHZ  
Single Trace  
High Sensitivity  
LBO-513A



15-MHZ  
Dual Trace  
High Sensitivity  
LBO-514A



**CALL FOR SPECIAL INTRODUCTORY PRICES**  
**TOLL FREE (800) 645-9152** N.Y.S. (516) 435-8080

**FORDHAM**

260 Motor Parkway, Hauppauge, N.Y. 11787



- Master Charge
- VISA
- COD
- Money Order
- Check



# EQUIPMENT AND TRAINING NO OTHER SCHOOL CAN MATCH.

**NTS HOME TRAINING INVITES YOU TO EXPLORE MICROCOMPUTERS,  
DIGITAL SYSTEMS AND MORE, WITH STATE-OF-THE-ART EQUIPMENT  
YOU ASSEMBLE AND KEEP.**

Without question, microcomputers are the state of the art in electronics. And NTS is the only home study school that offers you training for this booming field with a choice of 3 production-model micro computers.

We'll explain the principles of troubleshooting and testing your microcomputer and, best of all, we'll show you how to program it to do what you want.

You'll use a digital multimeter, a digital logic probe and other sophisticated testing gear to learn how to localize problems and solve them.

Send for the full color catalog in the electronics area of your choice—discover *all* the advantages of home study with NTS!

NTS also offers courses in Auto Mechanics, Air Conditioning and Home Appliances. Check card for more information.

We believe that training on production-model equipment, rather than home-made learning devices, makes home study more exciting and relevant. That's why you'll find such gear in most of NTS's electronic programs.

For instance, to learn Color TV Servicing you'll build and keep the 25" (diagonal) NTS/HEATH digital color TV.

In Communications Electronics you'll be able to assemble and keep your own NTS/HEATH 2-meter FM transceiver, plus test equipment.

But no matter which program you choose, NTS's Project Method of instruction helps you quickly acquire practical know-how.







Simulated TV Reception

4.

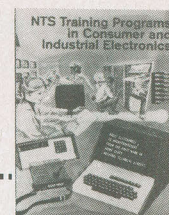
3.

3. The NTS/Heath HN-89A Microcomputer features floppy disk storage, "smart" video terminal, two Z80 microprocessors, with 32K RAM Memory, expandable to 64K on board. 4. The NTS/Heath GR 2001 Digital Color TV (25" diagonal) features specialized AGC-SYNC muting, filtered color and new solid-state high voltage tripler rectifier.

1. The NTS/Rockwell AIM 65 Dedicated Microcomputer A Single board unit featuring on board printer and display—4K RAM (expandable). Application Functions: Central processor—Controller/Monitor—Development System. 2. "The NTS/SYM-1 Microcomputer" 6502 Based CPU—4K bytes ROM (expandable)—1K RAM (expandable). 51 active I/O lines for versatile interfacing: disk drives, ASCII key boards, cassette tape, etc.

## NTS NATIONAL TECHNICAL SCHOOLS

TECHNICAL-TRADE TRAINING SINCE 1905  
Resident and Home-Study Schools  
4000 SO. FIGUEROA ST., LOS ANGELES, CA. 90037



### NATIONAL TECHNICAL SCHOOLS

4000 South Figueroa Street. Dept. 206-122  
Los Angeles, California 90037

Please rush FREE color catalog on course checked below

- |   |   |
|---|---|
| <input type="checkbox"/> MicroComputers/MicroProcessors | <input type="checkbox"/> Auto Mechanics     |
| <input type="checkbox"/> Communications Electronics     | <input type="checkbox"/> Air Conditioning   |
| <input type="checkbox"/> Digital Electronics            | <input type="checkbox"/> Home Appliances    |
| <input type="checkbox"/> Industrial Technology          | <input type="checkbox"/> Color TV Servicing |

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

Apt. \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

☐ Check if interested in G.I. information.

☐ Check if interested ONLY in classroom training in Los Angeles.



# STATE OF SOLID STATE

## Measuring relative humidity

ROBERT F. SCOTT, SEMICONDUCTOR EDITOR

A KNOWLEDGE OF THE RELATIVE HUMIDITY at any given time can permit us, or others around us, to make decisions that can affect our health, comfort and personal safety. In addition, the measurement of relative humidity (abbreviated RH) is vital in such areas as food processing, air conditioning, packing, photography, paper and lumber production, and chemical manufacturing. Knowing the RH—along with the temperature—can allow airport operators to predict fog and runway icing. Similarly, farmers and nurserymen can predict dew and frost; and highway safety authorities can forecast dangerous fog and icing on bridges.

Electronic circuits for humidity measurement have rarely appeared in the press because humidity-sensitive transducers have been expensive and seldom available to the electronics constructor and hobbyist. Now, for about

ten-dollars-worth of semiconductors and discrete components, and less than sixty dollars for the humidity sensor, you can build a direct-reading electronic hygrometer. The device, described in National Semiconductor's Application Note AP 256, is designed around the PCRC-55 humidity sensor, from Phys-Chemical Research, and a linear 0 to 10-volt DC meter.

### The sensor

The electro-humidity sensor has a hygrometric element whose impedance changes with changes in relative humidity. The hygrometric portion of the sensor is on the surface of a chemically treated styrene copolymer plastic wafer. Water vapor is sorbed or desorbed by means of adsorption (the adhesion of molecules to a surface; not the same as *absorption*). That

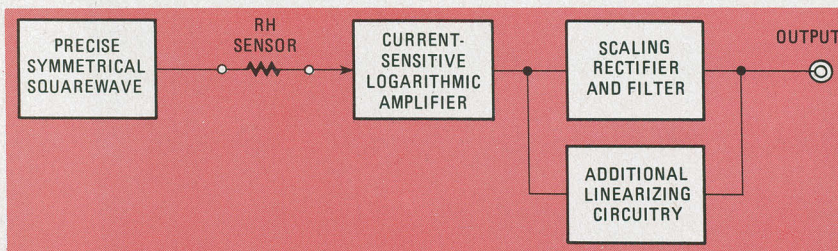


FIG. 1

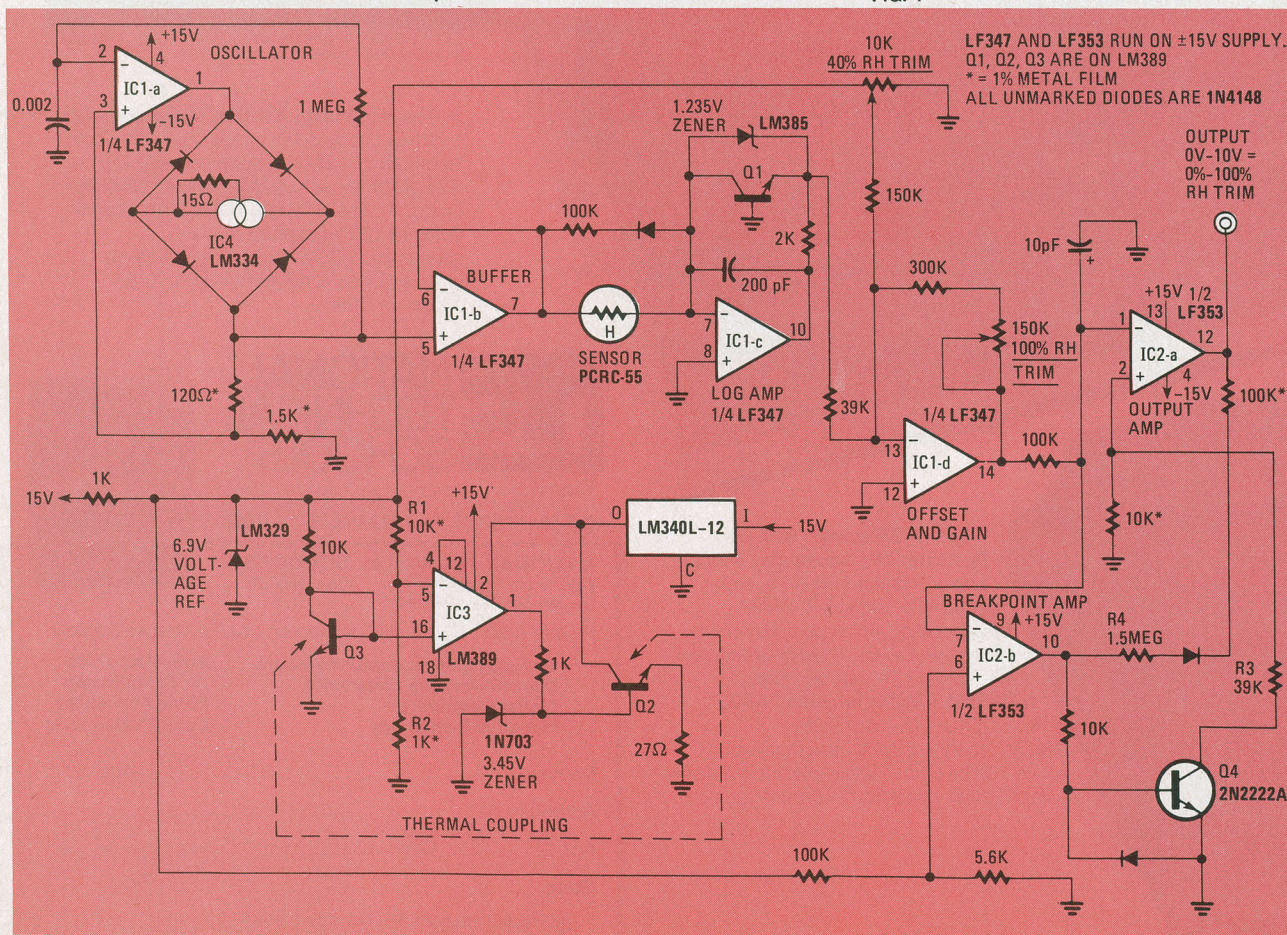


FIG. 2



results in the sensor's having a very rapid response to changes in relative humidity. A single sensor covers the complete range of relative humidity—from 0 to 100%.

The sensor should be excited only by AC voltages (preferably sinusoidal waveforms) of at least 20 Hz with no DC component. Sustained operation with a DC voltage, or AC with a DC component, causes a shift in calibration. The maximum allowable current is one mA.

Figure 1 is a block diagram of the electronic hygrometer. An amplitude-stabilized squarewave drives a precise alternating current through the sensor. The sensor's output current feeds a current-sensitive logarithmic amplifier to linearize the response. The output of the log amplifier is scaled, rectified, and filtered to provide a 0-10-volt DC-output representing RH's from 0 to 100%.

#### A practical circuit

In Fig. 2, a symmetrical squarewave is generated by IC1-a, an op-amp with positive feedback applied to cause it to oscillate. The combination of constant-current source IC4 and its associated diode-bridge clamps the squarewave output of IC1-a at +8 volts. IC4 has a positive temperature coefficient of 0.033%/°C, which almost completely compensates for the negative 0.036%/°C temperature coefficient of the PCRC-55 sensor. (Mount IC4 close to the sensor so they

will be at the same ambient temperature; that way the temperature coefficient of the complete instrument will approach zero.)

The squarewave is buffered, and then fed through the sensor into the summing junction of IC1-c. On negative-going halves of the squarewave, the  $V_{BE}/I_C$  characteristic of Q1, in the IC1-c feedback loop, gives the amplifier a logarithmic amplitude-response. On positive-going half-cycles of the squarewave, feedback through the diode to the summing junction ensures that this point remains at a virtual ground so the sensor always "sees" the required symmetrical drive-waveform.

The output of the log amplifier goes to IC1-d, an op-amp used to sum-in the calibration at the 40% RH point, and to provide adjustable gain for trimming the output to the proper level for a 100% RH reading. The output of IC1-d is filtered to DC by the 100K resistor and 10  $\mu$ F capacitor and then fed to IC2-a, the output amplifier.

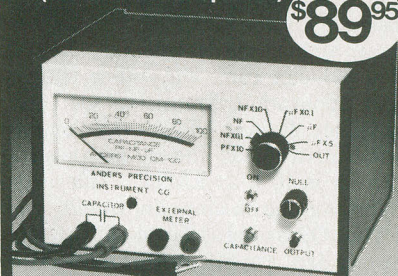
IC2-b compensates for the sensor's departure from linear response below 40% RH. It does that by altering the gain of the output amplifier when its input drops to about 0.36 volt—corresponding to 40% RH. The inverting input of IC2-b, the breakpoint amplifier, is tied to the non-inverting input of the output amplifier. When the input to those paralleled gates

OF THE EIGHT MAJOR  
CAPACITANCE INSTRUMENTS  
MADE, ONLY THE CM-100...

# DETECTS LEAKAGE

(and at half the price!)

**\$89<sup>95</sup>**



**Usefulness** — Measure capacitors 10pF — 500 $\mu$ F; leakage 1 nA or .005 C.V., whichever is greater. **Accuracy** — To 2% depending on range. **Dependability** — Ruggedized construction; 1 yr. warranty. **Versatility** — In circuit measurement of capacitance and leakage. Output signal proportionate to measurement. **Portability** — 350 Hr. Battery Life.

\* To 25,000 $\mu$ F with external voltmeter

Send check, address (NO P.O. BOX) plus \$3.50 Handling. CT res. add 7 1/2 % tax.

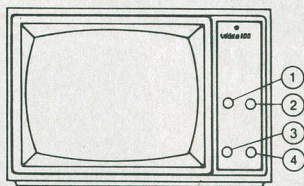
Phone orders: (203) 423-7940

**ANDERS PRECISION INSTRUMENT CO., INC.**  
4 Bridge St. Plaza, P. O. Box 75 Willimantic, CT 06226

CIRCLE 29 ON FREE INFORMATION CARD

## DO YOU KNOW WHERE YOUR COMPUTER IS TONITE?

by AMDEK



**VIDEO  
100**

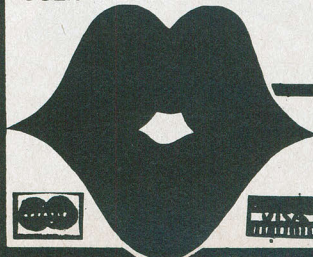
12" BLACK & WHITE  
MONITOR  
FULL FACTORY WARRANTY

**\$79<sup>95</sup>**

1. CONTRAST
2. POWER-BRIGHT
3. V-HOLD
4. H-HOLD

for **APPLE**  
**16K RAM CARD**

\* LANGUAGE TRANSPARENT  
**\$69<sup>95</sup>**  
COEX FACTORY WARRANTY



**floppy  
DISKETTES**

5 1/4" - 100 PER BOX  
ALL CERTIFIED - 100%  
GUARANTY

**\$149<sup>00</sup>**

ABOVE WITH HUB RINGS  
**\$169<sup>00</sup>**

**VISION-80** 80x24 Video

Display Card **\$249<sup>00</sup>**

Vista Computer Company's new Vision-80 board is a sophisticated yet easy to use video display card for the Apple™ computer.

**FLOPPY DISK DRIVE**

DESIGNED FOR YOUR APPLE **\$287<sup>95</sup>**

TRACK ZERO MICRO SWITCH  
DOS 3.2.1 & DOS 3.3  
PASCAL & CP/M

Fourth  
Dimension  
Systems

CONTROLLER CARD FOR ABOVE **\$99<sup>00</sup>**

**EXTENDER CARDS**

FOR APPLE... **\$16<sup>95</sup>**

FOR I.B.M.... **\$19<sup>95</sup>**

**PROTOTYPING CARDS**

**Apple** **\$19.95**

**I B M** **\$49.95**

NEW FROM COEX

**EPSON TO APPLE**

**PARALLEL INTERFACE!**

**\$49<sup>95</sup>**

**CABLE INCLUDED**

# Components Express, INC

1380 E. Edinger, Santa Ana, CA 92705 (714) 558-3972



drops below 0.36 volt, the output of IC2-b swings positive; that turns on transistor Q4 to produce the required change in the output amplifier. Transistor Q4 is turned off for RH values above 40%, so linearity is then determined solely by the log amplifier.

Transistor Q1, in the log-amplifier feedback loop, is extremely temperature sensitive and can adversely affect the performance of the amplifier. To compensate for that, the designers at National Semiconductor came up with a unique circuit application. Transistors Q1, Q2, and Q3 are discrete NPN devices on the same substrate as the audio power-amplifier in IC3, an LM389. Transistor Q3 serves as the on-chip temperature sensor while Q2 is used as the on-chip heater. The audio amplifier senses the temperature-dependent  $V_{BE}$  of Q3 and uses it to drive Q2 and heat the chip to a temperature (typically 50°C) set by the reference voltage at the junction of R1 and R2. That circuit stabilizes Q1's temperature and makes it immune to changes in ambient temperature.

To adjust the temperature-stabilizing circuit, ground Q2's base, apply power and then measure Q3's collector voltage. Make a note of the ambient room temperature. Now, calculate what Q3's collector voltage will be at 50°C; allowing  $-2.2\text{mV}/^\circ\text{C}$ . Adjust the value of R2 to develop a voltage close to the calculated

## UNDERSTANDING ATMOSPHERIC MOISTURE

Water covers over three-fourths of the Earth's surface, and there is always some moisture in the Earth's atmosphere—even over the driest desert. At times, as much as 4–5% of a portion of the atmosphere is water vapor or water in a gaseous state. The variation of the amount of moisture in the air (*humidity*) is influenced by geographic location, temperature, and wind currents. The most important of those is *temperature*. Heat causes some of the molecules of the Earth's surface water to escape into the atmosphere.

**Saturation** occurs when, at some temperature, the rates of evaporation and condensation balance. The space above the liquid contains all the water vapor it can hold. When that happens, the air is *saturated*. The amount of vapor a volume of air can hold before becoming saturated depends on the temperature; the higher the temperature, the more moisture the air can hold. Air can hold four times more moisture at 70°F than it can at 32°F.

**Absolute humidity** is a measure of the actual amount of moisture in the air at a given temperature. It is expressed either as the number of *grains* (one seven-thousandth of a pound) per cubic foot of air, or in terms of pressure in millibars or in inches of mercury.

**Relative humidity** is the moisture content of the air *expressed as a percentage*. It is the ratio of the absolute humidity to the greatest amount of moisture the air is capable of holding at the same temperature. As an analogy, consider a quart bottle that is half full of liquid. The ratio of its actual contents (one pint) to its capacity (one quart) is 50%. Similarly, a mass of air that is holding half the moisture possible at a given temperature has a relative humidity (RH) of 50%.

When the relative humidity is high (60% to 85%) we say the weather is muggy. Evaporation of perspiration is slow and we feel overheated. We are uncomfortable as it accumulates on our skin and clothing.

When the relative humidity is too low, perspiration evaporates too rapidly and we are uncomfortably chilly. Prolonged exposure causes our throat and nasal passages to become dry. When it comes to personal comfort, temperature and relative humidity are closely related. We enjoy relative humidities in the range of 45% to 55%.

Indoors in the winter when relative humidity is low, the comfort range is around 68°–74°F. Warm-air heating systems dry out the air and we often use humidifiers to raise the moisture content to a comfortable level. On a muggy summer day, we may use a dehumidifier to make indoor air drier. An air conditioner dehumidifies as it cools.

**Dew point** is the temperature at which air, as it cools, becomes saturated (RH is 100%) and water droplets condense on cool surfaces such as grass and plants. If the dew point is above 32°F, the condensate is dew. When the dew point is 32°F or lower, the condensate forms ice crystals that we call frost.

R-E

50°C potential at IC3's inverting (–) input. The range of values for R2 can be fairly wide because the exact chip temperature is not important as long as it is stable. Finally, remove the ground from Q2's base and the chip should reach the predetermined stable operating temperature within 100 ms. You can check temperature stability by reading Q3's collector voltage while blowing on IC3. The measured voltage should remain constant within 100  $\mu\text{V}$  (0.05°C).

## Calibration

To calibrate the electronic hygrometer, connect a 35K resistor in place of the sensor and adjust the 150K 100% RH TRIM pot for 10 volts output. Now, substitute an 80-megohm resistor for the sensor and set the 40% RH TRIM pot for 4 volts at the output terminal. Repeat the 100% RH TRIM and 40% RH TRIM adjustments until they no longer interact with each other. Finally, substitute a 60-megohm resistor for the sensor and select a 39K resistor for R3; that will develop a 2.4-volt output corresponding to 24% RH. It may be necessary to select a particular 1.5-megohm resistor for R4 to minimize jitter in the meter reading around the 24% RH point.

As this is written, the sensor is priced at \$57.00, \$54.00, and \$51.50 each, in lots of 1 to 24, for devices with RH deviations of  $\pm 1\%$ ,  $\pm 1.5\%$ , and  $\pm 3\%$ , respective-

## YOUR EXCITING NEW HOBBY!

- Enjoy fantastic savings by assembling your own organ or piano.
- It's easy. No technical knowledge required.
- Just follow our clear, pictured instructions.
- Choose from many models from portables to consoles.
- Ask about our interest-free installment plan.

**WERSI**

**ORGAN & PIANO KITS**

For Free Information Pack M40  
Call Toll Free  
800-233-3865  
In PA 717-299-4327

or send  
coupon  
below



WERSI Dept. M40 P.O. Box 5318  
Lancaster, PA 17601

- ☐ Free Info. Pack: ☐ Organ ☐ Piano  
☐ Catalog & Demo Record (enclose \$6)

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone (\_\_\_\_\_) \_\_\_\_\_

Rep inquiries invited

## A 10 HOUR TAPE RECORDER NOW only \$95.00\* WAS \$125.00 LONG PLAY

Modified Panasonic Slimline high quality AC-DC Recorder provides 5 continuous hrs. of recording & hrs. of top quality sound on each side of cassette for a total of 10 hrs. Built-in features include:

- Voice level control
- Digital counter, etc.
- TDK DC-180 Cassette included.



## PHONE RECORDING ADAPTER

Records calls automatically. All Solid state connects to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up. \$24.50\* FCC APPROVED

## VOX VOICE ACTIVATED CONTROL SWITCH

Solid state. Self contained. Adjustable sensitivity. Voices or other sounds automatically activate and control recorder. Uses either recorder or remote mike. \$24.95\*

\*Add for ship. & hdlg. Phone Call Adapter & VOX \$1.50 ea.—Recorder \$4.00. Cal. Res. add tax. Mail order. VISA, M/C, cod's ok. Qty. disc. avail. Money back guar. Free data. Dir. inq. inv. AMC SALES, Dept. A, 9335 Lubec St., Box 928, Downey, CA (213) 902-41 Phone 869-8519



CIRCLE 28 ON FREE INFORMATION CARD



# SERVICE CLINIC

## A common cause JACK DARR, SERVICE EDITOR

THIS MONTH'S TITLE HAS NOTHING TO DO with any political organization. It refers to a problem in TV sets that can be puzzling if you don't know about it. If you've been with me for a long time, you'll soon realize that I've covered this ground before. However, I've noted of late that I'm getting quite a few letters in the mailbag concerning what is obviously this particular problem so I thought it would be a good idea to discuss it once again.

The problem in question has one characteristic symptom—the set suddenly develops *many* symptoms at the same time! It may have poor sync, weak video, poor- or off-color, and so on. Common sense tells us that it's unlikely for many parts or circuits to all go bad at the same time. (Unlikely, but definitely not impossible!) So, what we should look for is a common cause—something that's common to all stages (and that's where the title comes from, at least in part).

In every TV set ever made, there's one circuit that fits that description—the DC power-supply. The DC supply has two functions; one, of course, is to supply the operating voltages to all the stages of the set. The other is the cause of the problem. The B+ supply also serves as the *common return* path for signals from every stage. Figure 1 will give you an idea of what I mean. The large filter-capacitors in the B+ supply provide a very-low-impedance path to ground or common (there's the rest of the title) for AC only; the impedance is a decimal point followed by about ten zeros and a 1.

If one of the filter capacitors develops a defect such as high power factor, or even opens, that raises the impedance in the common return-path and all the signals returning to ground develop signal voltages across that impedance. Those signals float around the B+ network, and

"back-up" into the other stages, where they immediately cause trouble by beating with the normal signal. That is plain old-fashioned feedback, and you know what that causes—oscillation, regeneration, beats, and other various and sundry problems.

Fortunately, there's a simple way to determine whether a bad B+ capacitor is at the root of your problem(s). Just touch a scope probe to a DC-voltage supply point on any of the circuits that are acting up. The normal response should be absolutely nothing; just a nice straight green line, even with a high vertical-gain. (Incidentally, that is the best possible test for either filter or bypass capacitors.) If you see any sign of a signal on the bypassed end of a circuit, you know that the filter or bypass capacitor is bad.

Try bridging a good capacitor across the suspect one. If the signals disappear and the problem clears up, you've found the cause (and cure). Replace the original capacitor with a good one.

Caution: perform this test with the power on *only in tube sets*. In all solid-state sets, turn the power off, connect the bridging capacitor, and then turn the set back on. The charging surge causes transients that can damage transistors, IC's, and other components.

That "common" problem causes some of the oddball symptoms we've all seen—the dark horizontal bar crawling up through the picture, bending or weaving at the sides of the raster, beats in the picture or color, AGC problems, etc.

One of the more unusual situations I ran across was a set with absolutely no vertical sync; the horizontal sync was steady as a rock. Scoping the composite-sync waveform at the output of the sync separator showed what looked like a normal pattern. A normal pattern will show

the vertical sync as thin lines every so often along the "bar" made up of the horizontal-sync pulses. I finally noticed that they weren't there (I hadn't looked close enough at first)! When I scoped the DC power-supply for the stage, I found that there was a small sharp spike at the vertical frequency.

That spike was feeding back into the sync-separator output, opposite in polarity to the sync pulses, and neatly punching out the vertical sync! The cause turned out to be a bad electrolytic capacitor in DC power supply.

So, there you are. If you find multiple symptoms, start looking for a common cause. Only one thing in the set fits that, and it is the DC power-supply. Solid-state sets, too, can suffer from the problem. In sets with low-voltage DC supplies derived from the flyback, look for pulses and hash on the DC at the horizontal frequency. Each supply has a rectifier diode *and* a filter capacitor. Check to make sure it is not open, leaky, or suffering from a high power-factor.

Your scope is the only instrument that will positively locate and identify the cause of that sort of trouble, so, if you suspect it, grab the scope probe and start looking; it can save you a whole lot of time.

R-E

## SERVICE QUESTIONS

### LOW VOLTAGE

*I've got a raster on this Sharp 3W77, but it is about an inch short on either side. All of the DC voltages (out of the flyback) are too low. There are also three pictures, side-by-side, on the screen.—J.C., West New York, NJ*

I think that the last symptom is the key to the entire problem. If your horizontal oscillator is that far off, it will upset the voltage from the flyback, and just about everything else. Fortunately, that is more or less a standard oscillator/AFC circuit. Ground the top of the AFC diode. That will kill the AFC and let the oscillator free-wheel. Now, tune the coil until you get just a single picture, with straight sides, floating back and forth. That indicates that the oscillator is back on fre-

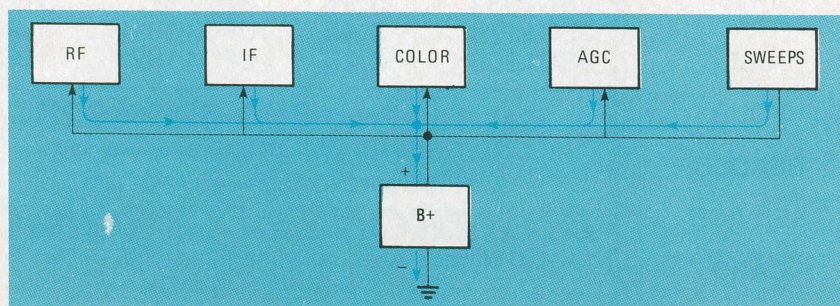
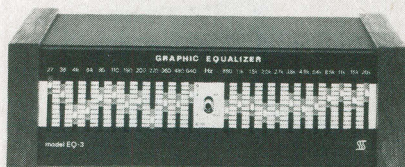


FIG. 1

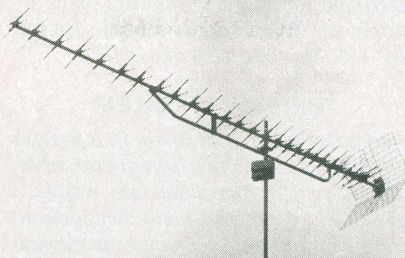




## 24-Band GRAPHIC EQUALIZER Kit

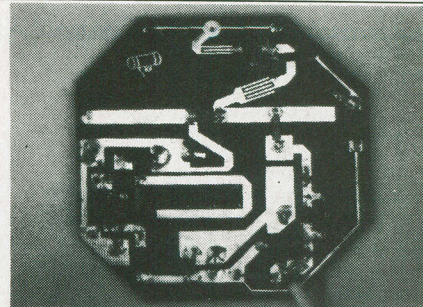
- 88dB S/N ratio • less than .02% THD
- Solid walnut ends • black anodized
- Only \$125 mono, \$225 stereo.
- M/C, Visa ok, free shipping w/check

Symmetric Sound Systems (707) 546-3895  
856A Lynn Rose Ct. Santa Rosa, CA 95404



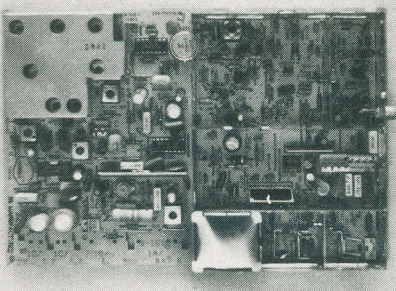
**ULTIMATE UHF FRINGE AREA RECEPTION**, receive snow free pay and commercial tv signals. The system includes a 114 element antenna, 39db LNA (Booster) and signal extractor for **\$199.95**. Complete documentation and warranty. 114 element antenna **\$109.95**, 39db LNA (Booster) **\$119.50**, signal extractor **\$39.95**. Dealer inquiries welcome. Visa - Mastercard accepted. Please specify channels. **DX-TELE LABS, 3822 N. Paradise Rd., Flagstaff, AZ 86001, 602-774-4735.**

CIRCLE 43 ON FREE INFORMATION CARD



**2300 MHz DOWNCONVERTER kit** for Amateur microwave reception. \$37.95 postpaid. Includes NE 64535 high-performance RF stages and highest quality components for superior performance. Send SASE for information filled catalog of other converter kits, preamps, accessories and parts. VISA and MASTERCARD accepted. **SMP - Superior Microwave Products, Inc. PO Box 1241 Vienna, VA 22180**  
1-800-368-3028 1-703-255-2918

CIRCLE 41 ON FREE INFORMATION CARD



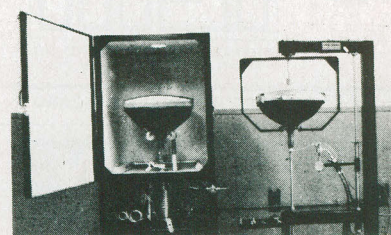
**TELEVISION MODULE** includes VHF, UHF, and CABLE-TV TUNER; IF AMPLIFIER and VIDEO DETECTOR, SOUND DETECTOR and AMPLIFIER, SYNC and SCAN PROCESSOR: **\$95.00**. TELEVISION SIGNAL PROCESSING MANUAL explores standard and non-standard television: **\$15.95**. Add 5% shipping and handling. Informative catalog: **\$2.00**. VISA and M.C. accepted. **ABEX, P.O. Box 26601-RT, San Francisco, CA 94126.**

CIRCLE 44 ON FREE INFORMATION CARD



ONLY \$89.95 complete with the following  
\* 75 to 300-ohm balun \* balun for rabbit ears  
\* 20" fiberglass parabolic dish \* low noise probe/down converter \* 60 ft. factor made coax \* 3 ft. coax \* power supply \* mounting hardware and instructions. All for only \$89.95 plus \$5.00 shipping & handling Visa, Mastercharge or C.O.D. cash or certified check. **NATIONWIDE G.H.Z., 6825 N. 16th St., Phoenix, AZ 85016 (602) 274-1199.**

CIRCLE 42 ON FREE INFORMATION CARD



**ONE MAN CRT FACTORY**, easy operation. Process new or rebuild old CRT's for tv's, bus. machines, monitors, scopes, etc. Color, b&w, 20mm, foreign or domestic. 3x6 ft. space required. Profits??? Average CRT rebuilding cost — \$5. Sell for \$100 = \$95 profit; x 5 CRT's = \$475 daily; x 5 days = \$2375 weekly profit. Higher profits outside U.S.A. Investigate this opportunity today. We service the entire world. Write or call:

**CRT Factory, 1909 Louise St., Crystal Lake, IL 60014, (815) 459-0666.**

CIRCLE 90 ON FREE INFORMATION CARD

## TRS-80™ COMPUTERS — BUY DIRECT-DISCOUNT PRICES

**VIC-20**  
The friendly computer

PURE RADIO SHACK EQUIPMENT - FREE COPY OF WARRANTY UPON REQUEST

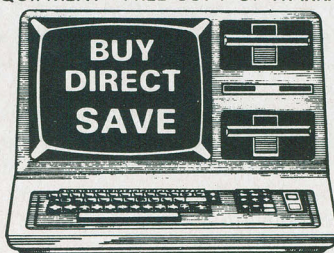
**SCM SMITH-CORONA**

**TOLL FREE 1-800-841-0860**

TRS-80 Model II. . . . . From **\*2899**  
TRS-80 Model 16. . . . . From **\*4098**  
TRS-80 Color Computer. From **\*289**  
TRS-80 Model III. . . . . From **\*599**  
Franklin Ace 1000. . . . . **CALL**

**Smith Corona TP-1**

**Daisy Wheel Printer... \*579**  
Mod I & III Hard Drives. . . . . **CALL**



*Thousands of Satisfied Customers Since 1978*

TM - Tandy Corporation

**WE CARRY THE FULL TRS-80 PRODUCT LINE**  
**\*WRITE FOR FREE CATALOG\***  
**MICRO MANAGEMENT SYSTEMS, INC.**

PARCEL DIVISION - DEPT NO. 15

2803 Thomasville Road East

Cairo, Georgia 31728

GA. & INFO 912-377-7120

CIRCLE 27 ON FREE INFORMATION CARD



# INTERNATIONAL FM-2400CH FREQUENCY METER FOR MOBILE TRANSMITTERS/RECEIVERS

Portable • Solid State • Rechargeable Batteries

The **FM-2400CH** provides an accurate frequency standard for adjustment of mobile transmitters and receivers at predetermined frequencies.

The FM-2400CH with its extended range covers 25 to 1000 MHz.

The frequencies can be those of the radio frequency channels of operation and/or the intermediate frequencies of the receiver between 5 MHz and 40MHz.

Frequency stability:  $\pm .0005\%$  from  $+50^\circ$  to  $+104^\circ\text{F}$ .

Frequency stability with built-in thermometer and temperature corrected charts:  $\pm .00025\%$  from  $+25^\circ$  to  $+125^\circ$  (.000125% special 450 MHz crystals available).

- Tests Predetermined Frequencies 25 to 1000 MHz
- Pin Diode Attenuator for Full Range Coverage as Signal Generator
- Measures FM Deviation



FM-2400CH (meter only) \$690.49  
RF crystals (with temp. correction) ..... \$28.89 ea.  
RF crystals (less temp. correction) ..... \$21.92 ea.  
IF crystals ..... catalog price

Write for catalog



INTERNATIONAL CRYSTAL MFG. CO., INC.  
10 North Lee Oklahoma City, Okla. 73102

CIRCLE 39 ON FREE INFORMATION CARD

## ATTENTION TECHNICIANS

ARE YOU TIRED  
of being

"only a serviceman"

or

"just a technician"?

THE LETTERS "CET  
AFTER YOUR NAME SPELLS  
"PRIDE"

TRY IT.

Take pride in  
your profession—  
Decide to be a CET



For information about: \_\_\_ exam dates;  
\_\_\_ requirements; \_\_\_ study guides;  
other \_\_\_\_\_

Send to: NESDA/ISCET  
2708 W. Berry St.  
Fort Worth, TX 76109  
(817) 921-9101

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ St. \_\_\_\_\_ Zip \_\_\_\_\_

quency. Remove the short from the AFC diode and the picture should lock in; if not, your AFC diodes may be bad—check and replace them if necessary.

### NO COLOR

I wasn't getting any color from a KE-chassis GE set. I made the tests you suggested and found the 2700-ohm plate resistor of the 6BW11 open. Thanks for the help.—G.M., Walled Lake, MI

### THERMAL PROBLEM

*I've got a thermal problem in a Sampo M-12B. The vertical lock is poor and, when it does lock, retrace lines are visible. I froze C604 and the problem disappeared until it warmed up. I replaced the capacitor, and the same thing happened. I also froze C505 and the problem disappeared...temporarily. A new C505 didn't help; nor did a new vertical IC and sync-separator transistor. Any ideas?—D.B., Selah, WA*

You obviously have a thermal problem—the question is where! Try cooling some of the resistors. While I tend to agree that the little low-voltage electrolytics are a likely cause, in your case they seem to be OK (installing new ones isn't a bad idea, though).

Resistors are subject to thermal drift, and that could easily account for the far-off DC voltages you found at the sync separator. As a last resort, check all the solder joints in the area you were cooling; cold-solder joints can be responsible for some weird problems. **R-E**

### JUST A FEW OHMS OFF

This Zenith 23GC45 suffered from poor vertical-height. I subbed the 9-92 module, but that didn't help. It finally turned out that R203—a 4.7-ohm resistor from pin 9 to ground—had increased in value to 6.5 ohms. I replaced the resistor and that took care of the problem. A good low-resistance scale on your meter is a handy tool!—D.H., Vacaville, CA  
*Amen!*

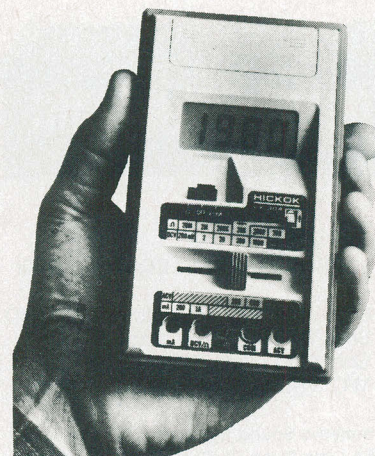
### FULL-WAVE BRIDGE QUESTION

*I'm puzzled about something I found while fooling around. If I feed an audio signal into a full-wave bridge rectifier, the resulting sound is badly garbled. If I add a DC bias to the rectifier's AC inputs, the audio sounds normal. Can you tell me what's going on?—J.G., Morgan Hill, CA*

I hope so. When you feed AC to a full-wave bridge rectifier, there are always two paths that conduct, and two that are blocked. That gives a DC voltage, with some ripple at the input frequency. That would be the equivalent of very severe clipping in an audio amplifier. The normal audio-signal at the output is AC floating on a DC signal; it can go either positive or negative, adding to or subtracting from the DC voltage.

When you added DC bias, you raised

## HICKOK LX304 A TOUGH Value to beat at \$99.95



Here is the truly inexpensive, high performance Digital Multimeter you've been looking for!

Lightweight, but rugged. Accurate. Precise. Reliable. Safe. Easy to hold and operate with the same hand. Made in the U.S.A.

All the super-durable, high quality professional meter you need for service and maintenance work.

- Automatic polarity, zero and overrange indication
- Easy to read  $\frac{1}{2}$ " high LCD display
- $\frac{1}{2}$  year battery life in typical use
- Withstands 4 ft. drop test
- Automatic decimal point, built-in low battery indicator, diode and transistor testing capability

**Priced under \$100, the LX 304 offers the best performance per dollar.**



THE HICKOK ELECTRICAL INSTRUMENT CO  
10514 Dupont Avenue • Cleveland, Ohio 44108  
(216) 541-8060 • TWX 810-421-8286

CIRCLE 97 ON FREE INFORMATION CARD



your audio signal above the DC level, which let it vary normally, and the audio came through.

### MISLEADING SYMPTOM

The raster in this Magnavox T982 took on a trapezoidal shape; usually that means a shorted yoke-winding. If you're wondering whether we tried changing the yoke, yes, we did.

Later, we found that the values of the filter capacitors in the power supply had decreased in value, allowing the vertical circuit to be "pumped" at the horizontal rate. Replacing the capacitors brought things back to normal. Watch out for this—not only in that chassis, but also in the T981 and T987.

Thanks to C.T., of Adelphi, MD, for the warning.

### NEGATIVE VOLTAGE

*There is no high-voltage, etc., on this J.C. Penney 685-4827. The B+ voltages seem to be OK and the horizontal oscillator seems to be working. When I checked around the output stage, I found a negative voltage on the plate of 40KD6 and the cathode of the 34CE3 damper tube. What is going on?—M.B., Newport News, VA*

Try this: Hook a DC voltmeter to the cathode of the damper tube and turn the power on. Watch the meter—if it comes up to full B+, disconnect the meter

quickly. If it shows zero, or, as you found, a small negative voltage, the cathode of the damper is probably open inside the tube. Check the continuity from the damper cathode to the plate of the 40KD6; that checks the primary winding of the flyback. Also, try a new damper tube—that is rarely the problem, but it is possible.

### NON-STARTING VERTICAL OSCILLATOR

*I've checked all the parts in the vertical circuit of this RCA KCS204A, but the oscillator simply won't start. I don't get it.—C.A.S., Snellville, GA*

Oscillators that won't start, even though all the parts check out OK, have been a common problem for years. Just remember that if a circuit won't work, there almost always has to be a bad part! In your case, I'd suspect an open capacitor in the feedback loop—if there's no feedback, there's no oscillation.

Double check: feed a 60-Hz signal to the input of the first stage of the oscillator. If you now get deflection, the amplifier part of the circuit is OK. (All vertical oscillators of this type are really just two-stage amplifiers with very heavy feedback from input to output.) If the amplifier is working, then the problem is in the feedback loop, and very likely to be an open capacitor. Check C609 and the others to see whether they're good. R-E



## 2 NEW OPTO DESIGN KITS!

Now you can have 36 different options for easy LED design right at your finger tips!

<h3>Opto Designer I</h3> <p>180 T-1 and T-1½ Red, Green, Yellow, Orange and Red-Orange LED Lamps <b>\$19.95</b></p>	<h3>Opto Designer II</h3> <p>180 Round, Square, Triangular, Rectangular and Cylindrical LED Lamps <b>\$24.95</b></p>
---	--

Send for **FREE LED BROCHURE**:  
 • 3 mm (T-1) 5mm (T-1½) • Round • Square  
 • Cylindrical • Triangular • Rectangular • High Intensity • Custom • Arrays • Two-color Round, Rectangular • Level meter panel displays.



**FREE 100 CB-50 T-1½ mounting Clips** if you order within 7 days

## ETRONIX

14803 NE 40th Street, Dept. RE 112  
Redmond, WA 98052

**YES, I would like to take advantage of your offer.**

☐ **Send me — Opto Designer I** @ \$19.95 plus \$3.00 shipping and handling.

☐ **Send me — Opto Designer II** @ \$24.95 plus \$3.00 shipping and handling.

Name \_\_\_\_\_

Address \_\_\_\_\_

Company \_\_\_\_\_

City \_\_\_\_\_ St. \_\_\_\_\_ Zip \_\_\_\_\_

Signature \_\_\_\_\_

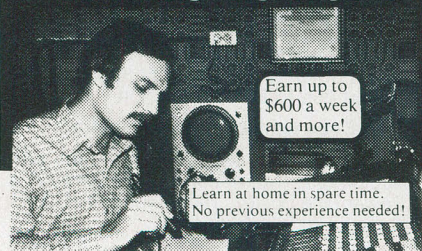
Please charge my ☐ Mastercard ☐ Visa

No. \_\_\_\_\_ Exp. \_\_\_\_\_

**CALL TOLL FREE 1-800-426-1044**

**CIRCLE 36 ON FREE INFORMATION CARD**

## Be an FCC LICENSED ELECTRONIC TECHNICIAN!



No costly School. No commuting to class. The Original Home-Study course that prepares you for the FCC Radio-telephone license exam in your spare time! Passing the exam is your "ticket" to thousands of exciting opportunities in Communications, Broadcasting, Mobile two-way systems, Microwave stations, Radar installations, Aerospace and more.

### NO NEED TO QUIT YOUR JOB OR GO TO SCHOOL

You learn how to pass the FCC License exam at home at your own pace with this easy-to-understand, proven course. Within a few short weeks you could be on your way to being one of the highest paid workers in the electronics field. It's that easy! U.S. Federal law requires you to have an FCC License if you want to operate and maintain virtually any communications system — you don't need a College degree to qualify, but you DO need an FCC License. With this Home-Study course, you'll be ready to pass the FCC Government licensing exam in a remarkably short time. Send for FREE facts now. No obligation. No salesmen will call. **MAIL COUPON TODAY!**

### COMMAND PRODUCTIONS

FCC LICENSE TRAINING, Dept. E  
P.O. Box 2223, San Francisco, CA 94126

Rush FREE facts on how I can prepare for my FCC License at home in my spare time.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

**CIRCLE 35 ON FREE INFORMATION CARD**

# STATISTICS

## NEW CALCULATOR METHOD!

**IF YOU HAVE TROUBLE WITH STATISTICS** this new method is for you. All you'll need is a calculator, plain or fancy, or your home computer. You cannot fail. Sure, you'll have to do some work, but if you can push a button you can learn statistics now.

**IT'S EASY WITH INTERESTING EXAMPLES** — you follow step-by-step calculator or computer key-strokes — instead of algebra.

Let me introduce myself — I'm Dr. George McCarty and I teach at the University of California. Tens of thousands of people like yourself have used my calculator method to teach themselves calculus. Now I have teamed up with another professor to put all those tested and proven techniques in one NEW STATISTICS GUIDEBOOK for you — it's 352 pages BIG, and its name is *Calculate Basic Statistics*.

**THIS METHOD IS FRIENDLY**, so you can use it on your own — before, during, after or instead of your first course in statistics. I'm certain I can show you this **easy** way to success with statistics, so **I guarantee it to you unconditionally** — if you are not satisfied just send it back for a prompt refund.

**BUT YOU'LL BE EXCITED** the very day it's delivered to you — you'll start right in calculating a basic statistic on page 1, so you'll get instant confidence

in your own ability to use my method. You'll read informal explanations with detailed calculations for topics like "confidence intervals" and "contingency tables" that are confusing in ordinary textbooks.

**SUPPOSE YOU HAVE ALREADY STUDIED STATISTICS.** You'll use Quick-Reference Guides to go straight to a topic you want to refresh yourself on — then get right-now answers in your own field — business, biology, science, psychology, education.

**YOU'LL BE DOING** Inference and Hypothesis Testing, the Chi-Square Distribution, ANOVA, Regression and Correlation, Non-Parametric Methods — they're all here.

**DO THIS NOW.** Order my statistics guidebook direct from the publisher — it is guaranteed to work with any calculator or computer. If you would like to start out with a fancy new calculator, order my complete kit — it includes the guidebook and a TI-35 calculator which finds means and standard deviations at the touch of a button.

As pennywise Ben Franklin said, "An investment in knowledge pays the best dividends." **GET STARTED NOW** — tax deductible for professionals.

*George McCarty*

**YES, I want to learn statistics fast and easy with your new method.** If I am not more than satisfied I can return it for a quick refund. **RUSH** me the guidebook or complete kit I select below (kit contains the guidebook and a modern TI-35 statistical calculator).

**MARKET SURVEY DISCOUNT:** I want to save \$1 on each guidebook or kit I order — here is the profession I'm going to use statistics for → \_\_\_\_\_

	STATISTICS GUIDEBOOK	KIT
How many?	<input type="checkbox"/> \$14.95 <input type="checkbox"/> \$39.95	
Handling/Shipping	1.00	2.00
Tax (within California)	.90	2.40
Market Survey Discount	—1.00	—1.00

#### TOTAL

For AIR SHIPMENT add \$3 per item

**PHONE MC or VISA ORDERS to (714) 831-2637**

OUTSIDE USA, surface shipping is \$2 per book or \$5 per kit and air shipment is \$5 per book or \$10 per kit — U.S. FUNDS please.

Enclosed is my ☐ Check, ☐ M.O.; or charge my MC or VISA card no. \_\_\_\_\_ expires \_\_\_\_\_

My name is \_\_\_\_\_

My address is \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Cardholder & mailing address if not as above \_\_\_\_\_

**EduCALC Publications**  
27963-S Cabot Road, Laguna Niguel, CA 92677

**TEAR OUT and MAIL TODAY — PROMPT SHIPMENT GUARANTEED!**



# NEW PRODUCTS

For more details use the free information card inside the back cover

**CB TRANSCEIVER SYSTEM**, Realistic model TRC-429, has 40 channels and has been designed for easy, one-hand operation. The speaker, microphone, and all operating controls are in the handset, including the volume and squelch controls, push-to-talk switch, and a rotary channel selector with



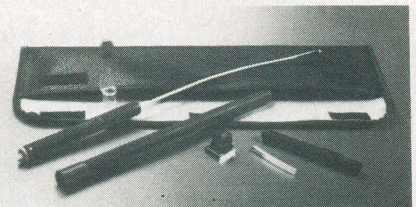
CIRCLE 121 ON FREE INFORMATION CARD

LED back-lighted channel indicator. The unit comes with a universal mounting bracket for easy installation under the dash or seat, in the glove compartment, or in the trunk—almost anywhere in a car, truck, boat, or airplane. (For installation in the trunk, there is an optional extension cable, priced at \$29.95.)

The model TRC-429 has 0.5-microvolt sensitivity (for 10 dB signal plus noise to noise), and adjacent channel rejection of 60 dB (at 10 kHz); it also features built-in ANL (Automatic Noise Limiter) circuitry to reduce interference. Dual MOSFET "front-end" RF circuitry brings high sensitivity plus freedom from cross-modulation and other RF distortion products. The frequency-synthesizer circuitry uses a state-of-the-art digital phase-locked-loop (PLL) for stable on-channel communications.

The Realistic model TRC-429 is priced at \$139.95.—**Tandy Corporation/Radio Shack**, 1800 One Tandy Center, Fort Worth TX 76102.

**VISUAL TOOL**, the Bend-A-Light, model BO30K, is designed to meet the universal need for a light to get into those impossible holes, cracks, and cavities encountered by everyone involved in building, repairing, or

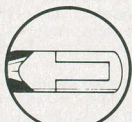


CIRCLE 122 ON FREE INFORMATION CARD

servicing today's complicated machines and devices.

The Bend-A-Light is a high-intensity, optically focused light on a ten-inch flexible shaft which can be bent and rebent to fit into any 1/4-inch hole or crack for inspection, retrieval of parts, or repair. The brilliant pinpoint of light

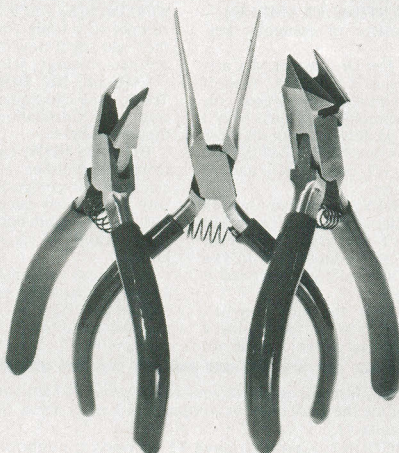
## TOP GRADE HAND TOOLS TO FIT YOUR POCKET BOOK



FEATURES BOX JOINTS



ADJUSTABLE COIL SPRING



HAND MADE



HUMAN ENGINEERED

Available at better distributors  
ADVANCED TOOL TECHNOLOGY, INC.

"Tools for Tomorrow's Technology"

18217 Parthenia St. • Northridge, CA 91325 • 213/993-1202

**ATT** ADVANCED TOOL TECHNOLOGY INC.  
a subsidiary of Alliance Research Corp.

CIRCLE 26 ON FREE INFORMATION CARD

PAT. # 4,259,705

### WARNING!

Electric Power Pollution, Spikes, Interference & Lightning  
**HAZARDOUS to HIGH TECH EQUIPMENT!!**



MicroComputers, VTR, Hi-Fi, Lasers, Spectrometers are often damaged or disrupted due to Power Pollution.

High Tech components may interact!

Our patented ISOLATORS eliminate equipment interaction, curb damaging Power Line Spikes, Tame Lightning bursts & clean up interference.

Isolated 3-prong sockets; integral Spike/Lightning Suppressor. 125 V, 15 A, 1875 W Total, 1 KW per socket.

ISO-1 ISOLATOR. 3 Isolated Sockets; Quality Spike Suppression; Basic Protection ..... \$69.95

ISO-3 SUPER-ISOLATOR. 3 DUAL Isolated Sockets; Suppressor; Commercial Protection ..... \$104.95

ISO-17 MAGNUM ISOLATOR. 4 QUAD Isolated Skts; Suppressor; Laboratory Grade Protection . . . \$181.95

Master-Charge, Visa, American Express

**TOLL FREE ORDER DESK 1-800-225-4876**  
(except AK, HI, MA, PR & Canada)

**SATISFACTION GUARANTEED!**

**Electronic Specialists, Inc.**

171 South Main Street. Natick, MA 01760

Technical & Non-800: 1-617-655-1532

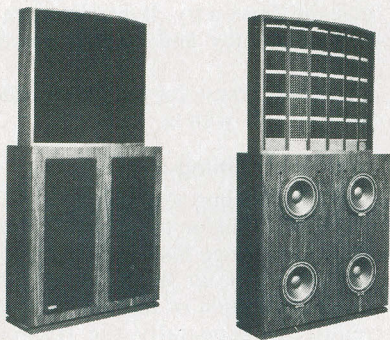
CIRCLE 32 ON FREE INFORMATION CARD



is effective up to 50 feet, and cannot reflect back into the user's eyes. Two AA batteries supply the necessary power. An unbreakable mirror, magnetic pick-up, and clip-on magnetic holder for "hands-free" operation are available accessories.

The *Bend-A-Light*, model *BO30K*, is priced at \$39.95.—**L & W Enterprises, Inc.**, 200 S. Washington, Royal Oak, MI 48067.

**SPEAKER SYSTEM**, JansZen model *ZS 30-4* is electrostatic and has two components. Designed and styled to disprove the notion that electrostatics have inherent shortcomings in the areas of power-handling



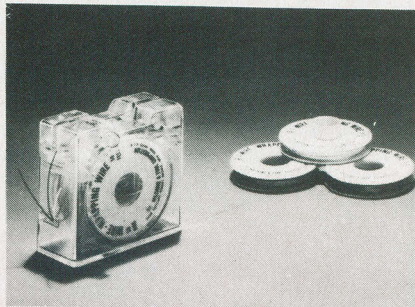
CIRCLE 123 ON FREE INFORMATION CARD

capabilities and dispersion characteristics, the model *ZS 30-4* has a new electrostatic diaphragm with the lowest mass of any material used heretofore, offers failure-proof electrostatic elements (nine thousands of one percent field-rejection rate), and has four

1-inch fiber carbon die-cast low-frequency transducers. High frequency is produced by thirty 5-inch electrostatic elements.

The model *ZS 30-4* is priced at \$450.00 a pair.—**JansZen Electrostatic**, Division of Soundmates, 796 29th Avenue Southeast, Minneapolis, MN 55414.

**WIRE DISPENSER**, model *WD-30-TRI*, holds three colors of wire and features built-in cutting and stripping mechanism. The refillable dispenser holds 50 feet each of red, white, and blue Kynar insulated, silver-plated, solid copper wire. To operate the cut-



CIRCLE 124 ON FREE INFORMATION CARD

strip mechanism, the wire is first drawn out to desired length; then a built-in plunger cuts the length free from the roll, while a gentle pull through the stripping blade removes the insulation. The model *WD-30-TRI* is priced at \$9.17; the three-color refill, model *R-30-TRI*, is priced at \$7.01.—**OK Machine and Tool Corporation**, 3455 Conner Street, Bronx, NY 10475. R-E

## PROTEUS I<sup>TM</sup> the lead synthesizer that has it all



### IS NOW \$100 OFF!

You've always had a lot of options.

You could have the convenience and easy operation of a normalized synthesizer if you were willing to give up the versatility of modular equipment.

Or the unlimited spectrum of tone colors and timbres of modules if you didn't mind the cumbersome patch cords and time required to set up or change a patch.

You could have programmable presets if you could raise the bucks, or low-cost equipment if you could stand the snap-crackle-pop.

You could even have such technically innovative features as computer control of voice and sequence if you had the technical savvy to design it all and make it work.

Now you have another option. **YOU CAN HAVE IT ALL.** Wide range, precise, low-noise, presets, meaningful patch bay and an easy-to-use computer interface.

All at a price that's nothing but unbelievable. the easy-to-assemble Proteus I Kit, ~~was \$499~~ now **\$399**

**ORDER TOLL-FREE WITH  
VISA OR MASTER CARD  
1-800-654-8657**

**Similar savings on other FAIA kits,  
ask for our free brochure.**

Want to know more? Proteus I's Using/Assembly manual which includes a demo tape will answer all of your questions. The price, \$10.00 is refundable upon purchase of the kit.

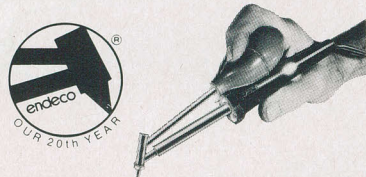
**Direct mail orders and inquiries to: Dept.12R**

**FAIA Electronics, Inc.**

1020 W. Wilshire, Oklahoma City, OK 73116 • (405) 843-9626

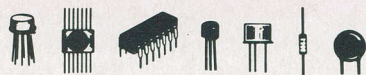
CIRCLE 40 ON FREE INFORMATION CARD

## Vital protection for PC Boards



Be safe. Desolder PC components with Endeco irons. Get *proper HEAT TO MELT and strong VACUUM ACTION TO LIFT* solder and *cool* both PC board and component without damage.

These PC components replaced fast with Endeco desoldering or soldering tools.



Endeco professional features include safety light that denotes *high*, *low* and *off* on switch models. SS construction for long life, light weight and balance for easy use.

Contact your distributor for Endeco desoldering and soldering irons, kits and equipment—or write us today.

**Enterprise Development Corp.**

5127 East 65th Street  
Indianapolis, IN 46220  
Phone: (317) 251-1231

CIRCLE 38 ON FREE INFORMATION CARD

## Macro PROFITS! MICROWAVE ANTENNAS at micro \$19<sup>95</sup> to \$199<sup>95</sup> prices

**Amateur  
32-Element  
Yagi Antenna**

• Not a kit, so it's easier to sell • 1.9-2.5 Ghz • 38½" long • Die-cast waterproof aluminum housing • Withstands temps -40° to +140°F. • 50-ohm type "N" connector • Mounting hardware included.

**Only \$19<sup>95</sup>**



**2 Ghz  
MICROWAVE  
ANTENNA**

**with 52 dB Overall Gain**

• Built-in down converters • Tune 1.9-2.5 Ghz • Operates on channels 2-6 • 22 dB gain resonant disc antenna • Standard 12-16 vdc power supply • Mounting bracket for horizontal or vertical polarity • Comes with 60' coax with connectors, 3' jumper cable, 75-300 ohm and 300-75 ohm adapters, complete instructions.

**\$139<sup>95</sup>**



**LONG-RANGE MICROWAVE ANTENNAS  
with Separate Down Converters  
FULL-YEAR WARRANTIES!**

**58 dB  
Gain**

**Just \$174<sup>95</sup>**

**62 dB  
Gain**

**Only \$199<sup>95</sup>**



• Tuneable temp-compensated L.O. • Power supply with built-in A-B switch • High gain, low noise figures • Convenient mounting tabs • Weather-resistant housings • For distant or low signal areas • Two microwave pre-amp stages • 2.1-2.3 Ghz • 20 Mhz input band-width • Noise figure: 5 dB • TV channels 2-6 • 75-ohm type "F" output • 50-ohm type "N" input impedance • Aluminum housing • Withstands temps from -40° to +140°F.

Dealer inquiries invited.

**G.M.A.**

79-59 264th St., Floral Park, N.Y. 11004  
212-929-3505/212-544-5990

CIRCLE 25 ON FREE INFORMATION CARD



# HOBBY CORNER

## Help from our readers

EARL "DOC" SAVAGE, K4SDS, HOBBY EDITOR

THIS MONTH SEEMS TO BE A GOOD TIME TO pause and thank those of you who have written to offer help to others. Your answers and suggestions are appreciated. It is a good time, too, to pass along some of your helpful hints to those who may have experienced similar problems.

### Little shocker

Ernest Worley of Irvine, CA went to the trouble of analyzing the "Little Shocker" circuit that appeared in the this column in the August 1981 issue. Among several improvements he suggested are two of special interest.

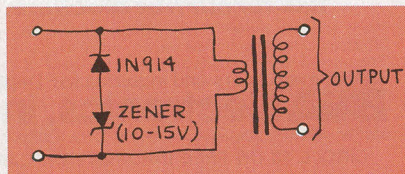


FIG. 1

The most significant change is shown in Fig. 1. If you compare it with the original circuit, you will see that Ernest has added a 12-volt Zener diode in series with the 1N914 across the primary of the output transformer. The Zener allows the transformer to make a more complete

### AN INVITATION

To better meet your needs, "Hobby Corner" will undergo a change in direction. It will be changed to a question-and-answer form in the near future. You are invited to send us questions about general electronics and its applications. We'll do what we can to come up with an answer or, at least, suggest where you might find one.

If you need a basic circuit for some purpose, or want to know how or why one works, let us know. We'll print those of greatest interest here in "Hobby Corner." Please keep in mind that we cannot become a circuit-design service for esoteric applications; circuits must be as general and as simple as possible. Please address your correspondence to:

Hobby Corner  
Radio-Electronics  
200 Park Ave. South  
New York, NY 10003

recovery with each pulse while still protecting the transistor from breakdown.

In addition, Ernest adjusted the values of the capacitor and resistors to increase the frequency to about 350 Hz and to bring the duty cycle to 50%. The end result is to give the shocker a bit more "zing" and, more importantly, to con-

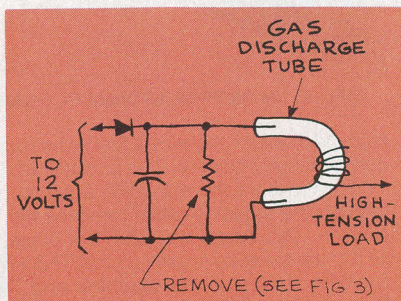


FIG. 2

former. If it is not a circuit like an audio amplifier, where fidelity is important, give the Zener a try. It may improve circuit efficiency and conserve battery power.

Thanks, Ernest, for sharing the battery-saving-Zener with us.

### Induction timing-light

David Reading of Marshfield, WI offers a good solution to James McDaniel's desire to change his timing light to the induction pick-up variety (April 1982). Careful selection of the few extra parts required—especially the triggering transformer—will allow you to fit it all into the original light case.

Figure 2 shows a basic high-tension timing-light circuit. Figure 3 shows a circuit with David's added parts (note that the resistor shown in Fig. 2 has been removed). He says any 4-kV trigger

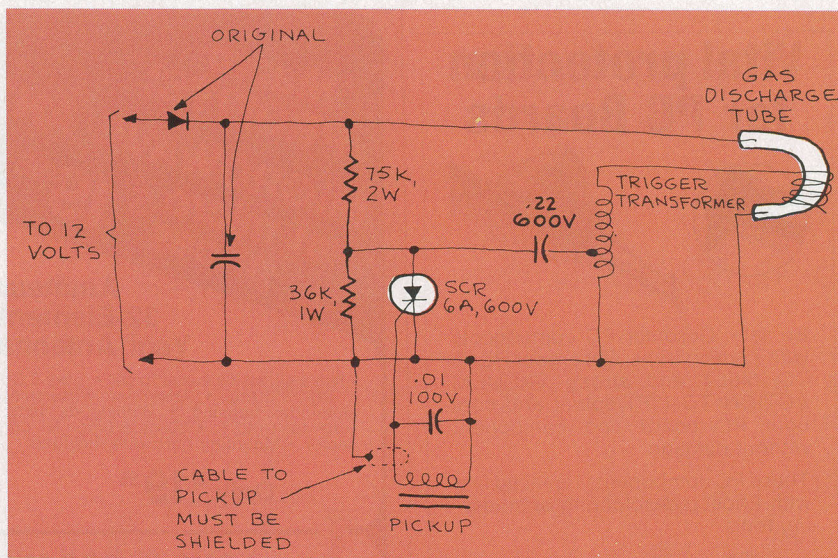


FIG. 3

serve battery life. You may recall that short battery-life was a characteristic of the original circuit, and the changes help get rid of that problem.

I am not calling Ernest's changes to your attention so much because the shocker circuit is especially deserving, but rather because the addition of the Zener diode across the primary of the transformer can be applied to other situations.

Often you will run across designs that couple transistor outputs through a trans-

former will work fine and suggests one sold by Mouser Electronics (11433 Woodside Ave., Santee, CA 92071) as their stock number 42FM401.

David has tried several different styles of induction pickups. All had three to five turns of wire around the core and they all worked fine. He cautions that the SCR must not be rated any lower than six amps at 600 volts.

Many thanks, David. Now all of us can give new life to those old timing lights.



## Bullet velocity

Randolph Richter (Schenectady, NY), J.A. Keys (Long Beach, CA) and others were quite helpful with the problem of measuring bullet velocity (December 1981). The solution, of course, is to measure the time it takes the bullet to travel over a known distance as accurately as possible.

The usual approach is to place two wires a given distance apart and then break them with the bullet. I acknowledge that the most difficult part of that procedure, at least to me, would be to hit the two wires! The experts tell me, however, that it isn't too hard to do provided that the wires are close and the rifle (or pistol) is supported by sand bags.

In any case, it is easy enough to measure the distance between the wires. Now, if you only knew the length of time between the breaking of the first wire and the breaking of the second one, finding the velocity would be easy.

Everyone seemed to go about timing the breaks in just about the same way. A counter circuit counts the pulses from a fast clock. The clock is triggered by the breaking of the wires—the first one starts it when broken, and the second one stops it. Knowing the clock rate and the number of counts, it is simple to figure the time that has elapsed between the breaking of the two wires.

After you know both the distance and the time, you can divide the first by the second to get the velocity. Let's now look at the actual techniques our readers used.

J.A. and Randolph use different circuits to measure the time. J.A. uses an internally triggered commercial counter that's enabled by an EXCLUSIVE-OR gate. The two wires are, of course, connected to the gate inputs. When one is broken the counter starts; it stops when the second wire is broken.

Randolph, on the other hand, built his gear from designs in Radio Shack's *Engineer's Notebook*. His circuit also consists of counters and a clock, but the triggering setup he uses is a little different. In that setup, he has the clock running before he fires and uses the breaking of the first wire to start the counter.

Breaking the second wire stops the clock by turning off its power. When the clock stops, there are no more pulses for the counter to count and the display freezes, showing the number of pulses that were counted between the wire breaks. Neat!

If you are thinking of measuring bullet velocities, I should tell you that almost every response to this problem that I received included one piece of advice: OBSERVE FIREARM SAFETY PROCEDURES! That is very important and only a fool thinks it is "silly" to repeatedly go through a safety checklist when conducting tests like this.

Forgetting about guns for the moment,

you can measure the speed of almost anything with the system described here. It will completely eliminate errors due to human reaction-time, as well as errors (real or imagined) that might be due to favoritism.

Certainly, anything slower than a bullet will present no difficulty. All you have to do is to slow down the clock to a rate that is appropriate to the event you are measuring.

## Mosquitoes again

Summer is an interesting time of the year. Many of you become involved in warm-weather activities and electronics experimenting receives less attention than it does in other seasons. Your outside activities bring to mind (and body) the problem of mosquitoes, and what can be done about them.

Last summer was no exception. Several readers wrote to ask for information or a circuit for a mosquito repeller. If you have a problem with those infernal pests, you may wish to refer to "Hobby Corner" in the March 1980 and February 1981 issues of *Radio-Electronics*. There you will find a circuit and some comments about its value.

It may be helpful to summarize the comments I have received over the last couple of years. Before you plunge into building a repeller, you should know that the number of readers who think it is great is about equalled by the number who think it is of no value at all! Until there is more information, I wouldn't recommend that you build one except on an experimental basis.

I am beginning to think that the effectiveness of a mosquito repeller is, like beauty, in the eye of the beholder. Certainly, there is no consensus of opinion on the question.

It occurs to me that, in addition to the psychological aspects of your reactions, there is the probability that certain components in the circuitry are critical. The speaker, for instance, could make a considerable difference in the unit's effectiveness. (Has anyone tried using one of those inexpensive piezo-element tweeters?) In addition, I have been led to believe that the frequency of the oscillator is critical.

It would be nice to resolve the question once and for all. If you have any information on the effect of sound on mosquitoes (or other insects), how about sharing it with the rest of us? If you have built a repeller that seems to work, let us know the exact parts you used and the oscillator frequency, as close as you can measure it. If you have done any actual experimenting with sound and the little beasties, tell us about your results.

Because of the continuing interest, I'll start a "mosquito" file and share its contents from time to time. If you have anything to contribute to that file please write in and share it with us.

R-E

# TS1000-ZX81 OWNERS KRAKIT™ WIN \$20,000 or more

KRAKIT™ is an adventure and a treasure hunt for the ZX81 and TS1000 computers. The bank account and prize money actually exist. Be the first to crack the puzzle and the prize is yours. Only one prize will be awarded.

## SOLVE 12 CLUES LIKE THIS!

*Where it all began. Where the torch was first lit. Where muscles and sinews strain. Where our heroes win acclaim. Where the symbols hold the key.*

KRAKIT™ consists of 12 clues on a ready-to-run ZX81 or TS1000 cassette tape (16k RAM). The answer to each clue is the name of a country, a city or town, and a number. If you are the first qualified entrant to solve all 12 clues and declared the winner, you receive two tickets to the city of the secret KRAKIT™ vault location. When you arrive at that location, a check for a minimum amount of \$20,000.00 (U.S.) will be presented to you. The amount of the prize money is augmented weekly.

## TS1000-ZX81

### RULES

1. The first qualified entrant to be confirmed by the judges to have completed all the clues correctly is the winner.
2. There will be one winner only.
3. No persons connected to International Publishing & Software Inc. or their families are eligible to enter KRAKIT™.
4. This offer is not valid where prohibited by law.
5. Due to the confidential nature of KRAKIT™ we regret we are unable to enter into any individual correspondence. All the required information, including how to claim the prize, is on the computer tape.
6. The winner will be required to sign an affidavit of compliance with these rules.



INTERNATIONAL PUBLISHING & SOFTWARE INC.  
P.O. BOX 1654, BUFFALO, N.Y. 14216



Mail to:  
INTERNATIONAL PUBLISHING & SOFTWARE INC.  
P.O. BOX 1654, BUFFALO, N.Y. 14216

Please send \_\_\_\_\_ copies of KRAKIT™  
at \$19.95 plus \$1.50 shipping.

Total \_\_\_\_\_ enclosed is ☐ check ☐ money order

Charge to ☐ Visa ☐ Mastercard

Number \_\_\_\_\_

Expiry \_\_\_\_\_ Signature \_\_\_\_\_  
Please Print

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Allow 2 weeks for personal checks.

Dealer inquiries welcome.

CIRCLE 98 ON FREE INFORMATION CARD



Get Serious About

**ZX81**

Computing



**PROFESSIONAL KEYBOARD.** Makes your ZX81 easier to use. Enter programs quickly and error-free. Plugs straight into your ZX81 without any soldering. Has 47 keys and a full space bar. **\$85.00**

**32K RAM.** Expand the memory capacity of your ZX81 with this direct-plug-in module. Fully compatible with Sinclair's 16K RAM (to give your ZX81 system a full 48K). **\$99.95**

**64K RAM.** Expand your ZX81 memory capacity to its maximum. Plugs in directly to your ZX81. **\$149.95**

## Software on Cassette

### MULTIFILE PLUS.

Data storage system for 16K to 64K systems. Flexible, user-defined setup. Includes program tape, detailed instruction manual, 3 data tapes, storage case. **\$34.95**

### GAMES

MAZOGS A maze-adventure **\$9.95**  
INVADERS 10 levels of play **\$9.95**  
STAR TREK Zap the Klingons **\$9.95**  
DICTATOR Political adventure **\$14.95**

### CONSTELLATION

Turn your ZX81 into a telescope with this amazing simulation of the night sky. Instructive booklet included. **\$14.95**

### PROGRAMMERS' AIDS

ZKAS Machine Code Assembler **\$9.95 each**  
ZXDB Dissassembler/Debugger

Call (716) 874-5510 for Visa, MC Orders.

**GLADSTONE** Electronics

Send \_\_\_\_\_  
Amt. enclosed \_\_\_\_\_  
Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Mail to Gladstone Electronics,  
1585 Kenmore Ave., Buffalo N.Y. 14217  
Checks or money orders. No CODs. Add shipping.

CIRCLE 31 ON FREE INFORMATION CARD

Put Professional Knowledge and a  
**COLLEGE DEGREE**  
in your Electronics Career through

**HOME  
STUDY**



**Earn Your  
DEGREE**

No commuting to class. Study at your own pace, while continuing your present job. Learn from easy-to-understand lessons, with help from your home-study instructors whenever you need it.

In the Grantham electronics program, you first earn your A.S.E.T. degree, and then your B.S.E.T. These degrees are *accredited* by the Accrediting Commission of the National Home Study Council.

Our *free* bulletin gives full details of the home-study program, the degrees awarded, and the requirements for each degree. Write for *Bulletin R-82*.

**Grantham College of Engineering**  
2500 So. LaCienega Blvd.  
Los Angeles, California 90034

## ANALOG CIRCUIT

*continued from page 78*

of  $r_e$  and  $r_b$  are negligible when compared to  $R_E$  and  $R_B$  and can therefore be ignored. The load across  $R_E$  can be very small, but should be no less than ten times the calculated output impedance.

In addition to the direct-coupled Darlington arrangement, transistors can be connected in series or in parallel. When

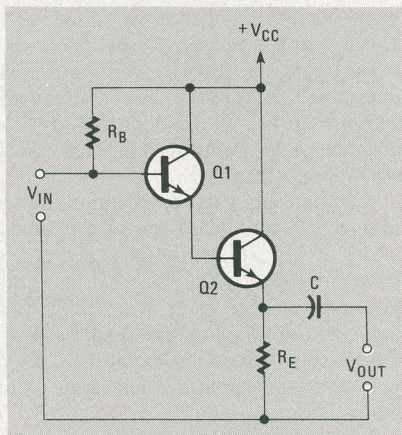


FIG. 6—THE DARLINGTON AMPLIFIER consists of two cascaded emitter-follower circuits.

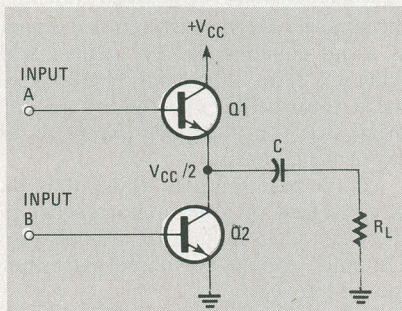


FIG. 7—WHEN TWO TRANSISTORS ARE connected in series, the supply voltage ideally will be split evenly between the two devices.

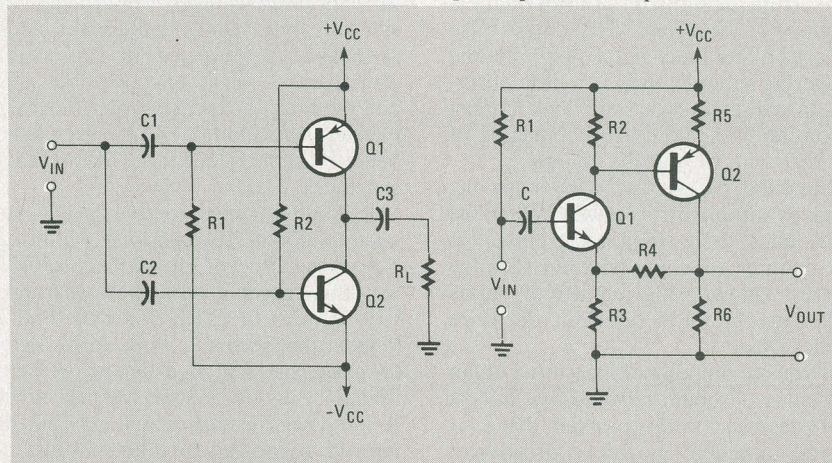


FIG. 8—COMPLEMENTARY TRANSISTOR CIRCUITS. The one shown in *a* is a push-pull audio amplifier. The one shown in *b* can be modified to meet a variety of circuit requirements.

connected in parallel, a two-transistor combination can theoretically deliver twice the current each individual device is capable of supplying. For that to be true,

the current they must pass must divide evenly between the two devices. That of course, never happens. Actually, the current rating of each transistor should be reduced by at least 20% to keep the devices in the circuit from being destroyed. One method of equalizing the currents in the transistors is to place a small resistor in series with the emitters of each one. That, however, reduces the amount of power the circuit can deliver for a given power-supply voltage. As for the series circuit, ideally the supply voltage divides evenly between the two devices, as shown in Fig. 7.

Complementary pairs are used quite frequently in direct-coupled circuits. One common use for that type of arrangement is in a push-pull audio-amplifier circuit, such as the one shown in Fig. 8-a. In that amplifier, the positive half of the input signal's cycle is fed to one transistor, in this case Q2, while the negative half is fed to the other, in this case Q1. The two halves of the signal combine across  $R_L$  to reproduce the full cycle. In a practical application,  $R_L$  could be a loudspeaker.

The complementary-pair circuit shown in Fig. 8-b can be modified depending on the requirements of the circuit. In the circuit as shown, the current gain is the product of the betas of the two transistors, the voltage gain is  $1 + (R_4/R_3)$ , and the power gain is the product of the voltage and current gains. The input impedance is approximately equal to  $R_1$  while the output impedance is  $R_4R_6/(R_4 + \beta_2R_6)$ , where  $\beta_2$  is the beta of Q2.

Two variations of the circuit shown in Fig. 8-b are frequently used. In one,  $R_4$  is omitted while  $R_3$  and  $R_5$  are shorted. Now, voltage gain drops to 1 and the output impedance becomes equal to  $R_6$ .

In the second variation,  $R_2$  and  $R_3$  are omitted while  $R_4$  and  $R_5$  are shorted. Now the characteristics are the same as for the first variation except that the output impedance drops to near zero.

Another form of direct-coupled circuit is the differential amplifier. That extremely useful circuit will be the subject of the next part of this article. **R-E**



# MARKET CENTER

## EDUCATION & INSTRUCTION

**UNIVERSITY** degrees by mail Bachelors, Masters, Ph.D.'s...Free revealing details. **COUNSELING**, Box 317-RE12, Tustin, CA 92680

## Be an FCC LICENSED Electronic Technician

Earn up to \$600 a Week & More!  
No costly school — The Original FCC Tests. Answers exam manual that prepares you at home for FCC General Radiotelephone License. Newly revised multiple-choice exams cover all areas tested on the actual FCC Govt exam! No previous experience required. \$12.95 post-paid. Moneyback Guarantee.  
Dept. E P.O. Box 26348, San Francisco, CA 94126



## ATTENTION ELECTRONIC TECHNICIANS

Highly Effective Home Study BSEE Degree Program for Experienced Electronic Technicians. Our New Advanced Placement Program grants Credit for previous Schooling & Professional Experience. Advance Rapidly! Our 36th Year!  
FREE DESCRIPTIVE LITERATURE!  
Cook's Institute of Electronics Engineering  
DESK 15, P.O. BOX 20345, JACKSON, MS 39209



## SATELLITE TELEVISION

**PRICE** break on 7 foot parabolic antennas. \$116.00. U.P.S. shippable. Send \$1.00 for brochure to: **BOB'S ELECTRONIC SERVICE**, 7605 Deland Ave., Fort Pierce, FL 33450

**DRAKE** satellite receiver with modulator installed only \$969.00. Satellite and microwave catalog \$1.00. **TEM MICROWAVE**, 22518 97th Ave. No., Corcoran, MN 55374 (612) 498-8014

**NORTHSTAR** satellite antenna kit 12' system \$2400.00. "What does the future hold for you and satellite television?" \$7.95. Attention dealers: manufacturers direct pricing. We will not be undersold. Call or write **TOM SALLEE** (606) 356-7416, Rt. 5, Box 293A, Covington, KY 41015

## QUALITY MICROWAVE TV SYSTEMS

### 1.9 to 2.5 GHz Antennas

Complete System (Rad Style as pictured) \$124.95

Complete System (Reflector Style as pictured) \$149.95

Down Converter Assembled & Tested \$64.95

Power Supply (12 to 18v) \$49.95

Also Dish Style Antennas In Stock.

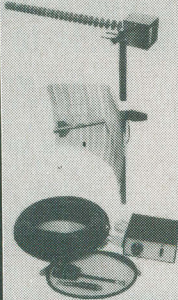
### Galaxy Electronics

6007 N. 61st Ave.

Glendale, Az. 85301

(602) 247-1151

COO's Quantity Pricing



90 DAY WARRANTY  
PARTS & LABOR

## RELIABLE MICROWAVE TV ANTENNAS

### 2.1 to 2.6 GHz

### Frequency Range

34db System Gain (or Greater)

Complete System (pictured) \$149.95

Down Converter Probe Style (Assembled & Tested) \$ 64.95

Power Supply (12V to 16V DC+) (Assembled & Tested) \$ 59.95

### PETERSON ELECTRONICS

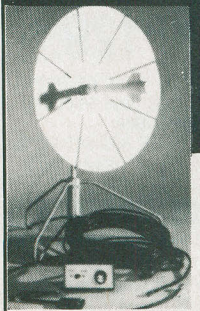
4558 Auburn Blvd

Sacramento, CA 95841

(916) 486-9071

SPECIAL QUANTITY PRICING

Dealers Wanted - COO'S



1 YEAR WARRANTY  
PARTS & LABOR



**SATELLITE** equipment catalog. Over 25 of the best manufacturers and suppliers. LNA's, receivers, antennas, and complete systems covered in four different sections. A satellite aiming chart and microwave interference handbook. (\$10.00 value) included free. Send \$9.95 U.S. **TMS CO.**, PO Box 8369, Roseville, MN 55113

**SATELLITE TV** low noise amplifiers, downconverters. East to build. Save hundreds of dollars! Exciting instruction manuals include everything you need to know! \$10.00 each or for more information write: **XANDI**, Box 25647, Dept. 21E, Tempe, AZ 85282

**INTERESTED** in Home Satellite Television—Don't buy anything until you've read the **Homesat Handbook & Buyers Guide**. Our book tells everything about home satellite TV and may save you hundreds, even thousands of dollars in your selection and installation of a system! \$10.00. **H & G HOMESAT SERVICES**, Box 422, Seaford, NY 11783

## SATELLITE TV MAGAZINE

Much More than a magazine.

**SATELLITE TV** is a complete guide.

SATISFACTION GUARANTEED OR MONEY BACK.

\$6.95 plus \$1.50 postage & handling.

**SATELLITE TV MAGAZINE**

P.O. Box 2384 - Shelby, N.C. 28150 - 704/482-9673

To run your own classified ad, put one word on each of the lines below and send this form along with your check for \$1.90 per word (minimum 15 words) to:

**Radio-Electronics**, 200 Park Avenue South, N.Y., N.Y. 10003

### ORDER FORM

**PLEASE INDICATE** in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of \$12.

( ) Plans/Kits ( ) Business Opportunities ( ) For Sale  
( ) Education/Instruction ( ) Wanted ( ) Satellite Television

Special Category: \$10

**PLEASE PRINT EACH WORD SEPARATELY, IN BLOCK LETTERS.)**

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

**PLEASE INCLUDE FOR OUR FILES YOUR PERMANENT ADDRESS AND PHONE NUMBER.**

**CLASSIFIED COMMERCIAL RATE** for firms or individuals offering commercial products or services). \$1.90 per word prepaid (no charge for zip code)...**MINIMUM 15 WORDS**. 5% discount for 6 issues, 10% for 12 issues within one year, if prepaid.

**NON-COMMERCIAL RATE** (for individuals who want to buy or sell a personal item) \$1.25 per word prepaid...no minimum.

**ONLY FIRST WORD AND NAME** set in bold caps. Additional bold face (not available as all caps) at 10¢ per word. All copy subject to publisher's approval. **ADVERTISEMENTS USING P.O. BOX ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SUPPLIES PUBLISHER WITH PERMANENT ADDRESS AND PHONE NUMBER.** Copy to be in our hands on the 26th of the third month preceding the date of the issue (i.e., August issue closes May 26). When normal closing date falls on Saturday, Sunday, or a holiday, issue closes on preceding working day.

**SATELLITE** antennas—computer generated pointing angles for your location—angles for both polar and alti-azimuth mounts provided—13 satellites covered—\$6.00. **REDDIG SCIENTIFIC**, 5331 Hickman Road NE, Newark, OH 43055

**SATELLITE** polar mount antenna break through. Build best under \$160.00. Write: **PROTOTYPE ENGINEERS**, Box 1812, Deming, NM 88030

**SATELLITE** receiver IF sweep generator 70 MHz IF. Sweeps 40 to 100 MHz—\$79.95. **HEAD END SYSTEMS**, PO Box 8758, Portland, OR 97207

## COMPUTER SOFTWARE

**SINCLAIR ZX80/81** users send for free software and copy of software newsletter, write **Z-WEST**, PO Box 2411, Vista, CA 92083

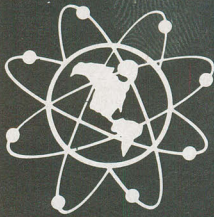
## COMPUTERS

**SAVE 90%**, Build your own 68000, 8086, Z80A, or 8080 microcomputer or minicomputer system. Free details. **DIGATEK CORPORATION**, Suite E., 2723 West Butler Drive, Phoenix, AZ 85021

## SLOW SCAN TV

**SEND** and receive video pictures over ordinary phone lines or amateur radio with **VIDEOSCAN**. Free brochure. **MICROCRAFT**, Box 513RE, Thiensville, WI 53092 (414) 241-8144





**MP SYSTEMS**  
**MP SYSTEMS**  
**MP SYSTEMS**  
**MP SYSTEMS**

**Fast, Reliable Service is Our Specialty.**

## MP SYSTEMS

**WILL IMPROVE**

**YOUR MEMORY . . .**

16K EXPANSION KIT 8 pcs 4116 200 ns	64K EXPANSION KIT 9 pcs 4164 200 ns
<b>\$11.95</b>	<b>\$74.25</b>

## AND DRIVE YOU

IMI's™ Industry Standard 5 1/4" Winchester Disk Drive	
6 mB	\$865.00
Siemens™ 8" Floppy Disk Drive	
FDD 100-8	\$300.00

## FRANKLIN ACE 1000 \$1350.00

## APPLE CLOCKCHIP

MM58167AN	\$ 15.00
-----------	----------

## EPROMS

2708	5.65	2716	5.50
2732	9.00	2532	12.00

## DB CONNECTOR

DB25P (RS232)	\$2.95
DB25S (Female)	4.25
Hood	1.80
DB9P	2.50
DB9S	3.37
Cover	1.10
DB15P	3.77
DB15S	4.21
Cover	1.25

## 6500 FAMILY

R6502P	\$ 6.95
R6511P	34.55
R6520P	4.00
R6522P	6.20
R6532P	8.55
R6545P	17.65
R6551P	8.75

## LPS II®

High resolution, high speed light pen for Apple II™ computers. Compatible with Franklin Ace 1000

**\$349.00**

**ASK FOR FREE FLYER**

**ASK FOR QUANTITY PRICING**

\$100.00 minimum order.  
Terms C.O.D. Prepaid or credit to rated firms.  
F.O.B.: Laguna Hills, CA.  
Shipping charges will be added.  
All pricing subject to change without notice.  
Call for quantity pricing.  
Bank cards accepted: MasterCard, Visa



**MP SYSTEMS**

23341 DEL LAGO  
LAGUNA HILLS, CA 92653  
(714) 770-6411

## FOR SALE

**MICROWAVE receiver system.** Write: "Dealers Wanted," Dept. RE, POB 4181, Scottsdale, AZ 85258 (602) 941-9395.

**THE Intelligence Library.** Restricted technical secrets—books on electronic surveillance, lock-picking, demolitions, investigation, etc. Free brochures: MENTOR, Dept. Z, 135-53 No. Blvd., Flushing, NY 11354

**RESISTORS** 1/4W, 1/2W 5% carbon films 3¢ ea. **NO MINIMUMS.** Cabinet assortments, 1% metal films. Request details. Bulk pricing available. **JR INDUSTRIES** 5834-C Swancreek, Toledo, OH 43614

**SAVE** up to 50% on name brand test equipment. Free catalog and price list. **SALEN ELECTRONICS**, Box 82-G, Skokie, IL 60077

**SCANNER/monitor accessories**—kits and factory assembled. Free catalog. **CAPRI ELECTRONICS**, Route 1R, Canon, GA 30520

**CABLE TV SECRETS**—the outlaw publication the cable companies tried to ban. HBO, Movie Channel, Showtime, descramblers, converters, etc. Suppliers list included. Send \$7.95 to **CABLE FACTS**, Box 711-R Pataskala, OH 43062

## SUPER SALE

EPROM's	1-7	8 up	50 up
2716 (5V, 450ns)	\$3.95	\$3.55	CALL
2732 (5V, 450ns)	7.49	6.55	CALL
2532 (5V, 450ns)	8.49	7.55	CALL
2764 (5V, 300ns)	19.95	CALL	CALL

## STATIC RAM

6116P-3 (150ns)	6.50	6.30	CALL
2114L-2 (200ns)	2.10	1.70	CALL

## DYNAMIC RAM

4164-2 (200ns)	7.90	7.49	CALL
(150ns also available)	CALL		

## MISC

CPU Z80A	\$5.29 ea.
CDP-1854ACE (UART)	\$4.80 ea.
16K RAM Expansion Kit for TRS-80 Mod III	\$12.95/8



**SUNTRONICS CO., INC.**

12621 CRENSHAW BOULEVARD  
HAWTHORNE, CALIFORNIA 90250

STORE HOURS: Mon.-Fri. 9:00am to 6:30pm — Sat. 10am to 5pm

IN CALIFORNIA OUTSIDE CALIFORNIA TOLL FREE

(213) 644-1149 1-800-421-5775

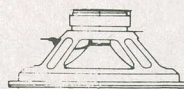
Min Order: \$10, P/H: \$2, Accept VISA, Mastercard, Check or M.O.

**POWER-AMP sub-assemblies**, 100 watts rms. .05% distortion, completely assembled and tested, quantity pricing available, free brochure. **CLAXTON AUDIO**, 3174 Periwinkle, Memphis, TN 38127

**IN-DASH AM-FM cassette stereo x-body** \$49.95, retail \$69.95. **C.H. WINDHAM**, 509 Midland Ave., Sanford, NC 27330

**ATTENTION:** Color computer users. Coco software and hardware catalog. Send SASE to **SPECTRUM PROJECTS**, 93-15 86 Drive, Woodhaven, NY 11421

**PCB 15¢ sq-in.** Free drilling. Quantity discount. **INTERNATIONAL ENTERPRISE**, 6452 Hazel Circle, Simi Valley, CA 93063



**WRITE FOR McGEE'S  
SPEAKER & ELECTRONICS CATALOG**

**1001 BARGAINS IN SPEAKERS**

Tel.: 1 (816) 842 5092

1901 MCGEE STREET KANSAS CITY, MO. 64108

**FREE speaker catalog!** Woofers, mids, tweeters, hardware, crossovers, grille cloth, plans, kits, information, much more. **Discount prices.** **UNIVERSAL SOUND**, Dept. RE, 2253 Ringling Blvd., Sarasota, FL 33577 (813) 953-5363

**NEW** color computer joystick. Has brush aluminum knob, hairtrigger firebutton, swivel type stick action, extra long cable and LED power indicator! \$39.95 + \$2.00 S/H. **SPECTRUM PROJECTS**, 93-15 86 Drive, Woodhaven, NY 11421 (212) 441-2807

## THE MARKETPLACE FOR NEW & USED

**ELECTRONIC EQUIPMENT**  
Delivered Monthly • Nationwide  
\$5.00 in U.S. - 1 YEAR - 3RD CLASS  
\$12.50 in U.S. - 1 YEAR - 1ST CLASS  
\$25.00 in U.S. - LIFETIME - 3RD CLASS  
To: **NUTS & VOLTS MAGAZINE**  
P.O. BOX 1111-E  
PLACENTIA, CA 92670  
(714) 632-7721

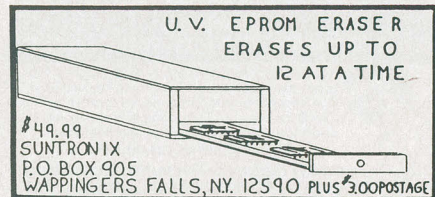
## NUTS & VOLTS

HAM GEAR  
COMPUTERS  
SOFTWARE  
SCANNERS • OPTICS  
TEST EQUIPMENT  
MICROWAVE  
AUDIO VISUAL  
SATELLITE  
NEW PRODUCTS  
COMPONENTS • KITS  
ANTIQUE ELECT.  
PUBLICATIONS  
PLANS • SERVICES

**MICROWAVE** antennas 2100-2600 MHz, downconverter probe, 18" parabolic dish 50' cable, power supply, 6 month warranty. **MDS ASSOCIATES**, 2709 Valecrest Road, Minneapolis, MN 55422. **JUST \$139.95**

**ANIK** noise filter eliminates unwanted audio noise from Canadian Satellite fully assembled and guaranteed. \$65.00 & \$2.00 shipping. **ARK ELECTRONICS**, P.O. Box 5689, Toledo, OH 43612

**THE Protector** cleans and prevents dust build-up on all your electronic equipment. Protect your investment with our **anti-static** silicone shield. \$4.95 includes shipping. **REEN CORP.**, 1241 NW Eighth Avenue, Miami, FL 33136



**PROTECT** your expensive computer, VCR, television, and stereo from harmful electromagnetic interference. Eliminate noise and static, protect against power line spikes with inexpensive filter. Guaranteed. Write for free information. **RAINBOW VIDEO**, 5 Roxbury Road, Rockville Centre, NY 11570

**FREE catalog** of surplus electronic parts and hardware. **UNIVERSAL SOUND**, Dept. RES, 2253 Ringling Blvd., Sarasota, FL 33577 (813) 953-5363

# ACTIVE RECEIVING ANTENNA

**Gives excellent reception,  
50 KHz to 30 MHz.**

**New MFJ-1024 Active Receiving Antenna** mounts outdoors away from electrical noise for maximum signal.

**Gives excellent reception** of 50 KHz to 30 MHz signals. Equivalent to wire hundreds of feet long. Use any SWL, MW, BCB, VLF or Ham receiver.

**High dynamic range RF amplifier.** 54 in. whip. 50 foot coax. 20 dB attenuator prevents receiver overload. Switch between two receivers. Select auxiliary or active antenna. Gain control. "ON" LED. Remote unit, 3x2x4 in. Control, 6x2x5 in. 12 VDC or 110 VAC with optional adapter, MFJ-1312, \$9.95.



**\$129.95**  
(+ \$4.00 shipping)

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping).

**One year unconditional guarantee.**

Order today. Call TOLL FREE 800-647-1800.

Charge VISA, MC. Or mail check, money order.

Write for free catalog. Over 100 products.

**CALL TOLL FREE 800-647-1800**

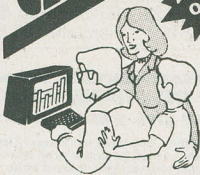
Call 601-323-5869 in Miss., outside continental USA, tech/order/repair info. TELEX 53-4590.

**MFJ ENTERPRISES, INCORPORATED**

Box 494, Mississippi State, MS 39762



# Poly Paks



AS SEEN ON TV!

## At Last !! The VERY Affordable TIMEX/sinclair 1000 COMPUTER

A PROGRAMMABLE PERSONAL COMPUTER featuring:

- Z80A Based Four Chip Design
- 2K Memory (Opt'n! 16K RAM Module Avail.)
- Durable 40 Key Membrane Type Keyboard • Single Key Entry
- Graph Drawing & Animated Display Facilities
- Use With Any TV & Cassette Player (Not Included) Size: 6 7/8" x 6 3/4" x 1 3/8"

### ONLY \$99

FREE! FREE! FREE!

Order This Computer With the 16K RAM Module, and Any Two Software Cassettes To Receive FREE THE MIXED GAME BAG #1 Cassette!



A7471

### TIMEX/sinclair 16K RAM MODULE

- Provides Use of More Sophisticated Software (See Software)
- Plugs Directly into the Computer for Instant Expansion From 2K to 16K
- Access to Greater Amounts of Data
- Size: 3" x 3" x 1 1/2" Cat. No. A7472

Only \$49

### Choose from Over 20 SOFTWARE PROGRAM CASSETTES

- VU-CALC Inventory Control
- Critical Path Analysis
- Manufacturing Analysis
- Flight Simulator
- The Stock Option Analyzer
- The Organizer • The Stamp Collector
- The Checkbook Manager
- The Budgeter
- The Loan Amortizer • Chess
- Grimm's Fairy Trails
- The Car Pooler • Super Math
- The Gambler • Backgammon
- The Coupon Manager
- The Cube Game
- States & Capitals
- The Mixed Game Bag #1
- Statistics

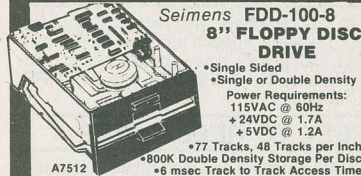
\$15.95ea.

\$12.95ea.

\$9.95ea.

\$14.95ea.

ALL PRODUCTS CARRY A 90 DAY MONEY-BACK GUARANTEE!



**PAK SPECIAL 3 or more \$299ea. \$279ea.**



**Reg. \$46.88 \$55.99**



**ONLY \$159**



**Reg. \$180 \$159.95**



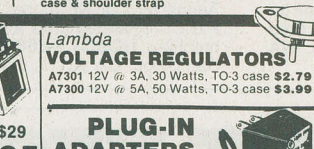
**ONLY \$189**



**\$59 ea. 2 for \$109**



**Reg. \$29 ONLY \$24.95**



**Reg. \$2.79 \$2.39**

Cat. No.	Description	Was	NOW
01307	10-Pin TO-5	4/51.29	4/51.16
01308	14-Pin DIP	4/51.29	4/51.16
04019	14-Pin DIP	4/51.29	4/51.16
01309	16-Pin DIP	4/51.29	4/51.16
03378	18-Pin	4/51.29	4/51.16
03886	24-Pin 5/8" spacing	2/51.29	2/51.16
03887	28-Pin 5/8" spacing	2/51.29	2/51.16
05202	40-Pin	each \$11.29	ea. \$11.16
01223	8-Pin Mini-DIP	4/51.29	4/51.16



**\$79 VALUE NOW \$49.00**



**Reg. \$16.88 \$13.67**



**ONLY \$29.00**



**2 for \$13 \$7.98**



**Reg. \$8.88 ONLY \$4.95**



**Reg. \$16.88 \$13.67**



**ONLY \$6.88**



**NOW ONLY \$2.84**

JUMBO			
Cat. No.	Lens	Lite	Similar to:
H2135	Red	Red	MV5053
H2136	Clear	Red	MV5050
H1945	Yellow	Yellow	KC5052
H2138	Green	Green	KC5586

JUMBO (TAPERED)			
Cat. No.	Lens	Lite	Similar to:
H2136	Red	Red	MV5052
H1792	Clear	Red	MV5050
H1945	Yellow	Yellow	KC5522

MEDIUM (STUBBY)			
Cat. No.	Lens	Lite	Similar to:
H2785	Red	Red	KC228
H3100	Clear	Red	KC209
H1942	Yellow	Yellow	KC222
H2788	Green	Green	KC22G

MICRO (TO-18 STYLE)			
Cat. No.	Lens	Lite	Similar to:
H2137	Red	Red	KC209
H1948	Clear	Red	KC209
H2140	Green	Green	KC209
H2143	Amber	Amber	KC209A

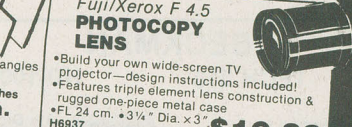
MICRO (TOP HAT STYLE)			
Cat. No.	Lens	Lite	Similar to:
H1788	Red	Red	MV505



**SPECIAL \$6.49**



**\$2.99 ea. \$3.99 ea.**



**\$10.88**



SEND FOR FREE CATALOG!  
OR CALL: TOLL FREE 800-343-3086

Min. Order \$10  
Shipping & Handling Add 3%  
Mass. Res. Add 5% Sales Tax  
Hrs: Mon-Fri 8:30 a.m. to 5 p.m., Sat til 12:30 p.m. EST

PHONE ORDERS SHIPPED IN 24 HRS. Except Sat & Sun



## FOR SALE

**UNUSUAL** UHF subscription TV kits. Also microwave downconverters. Catalog 20c. **TROJAN**, 2920 Shelby, Indianapolis, IN 46203

**PRINTED-circuit boards:** single side, prototype and quantity runs, quick delivery. Send positive, free quotes. **FABTRON**, Box 925, Columbia, TN 38401, (615) 381-1153

**VACUUM** pumps, diffusion pumps (three) picture tube ovens (two) disassembled. **PIERCE**, Rt. 4, Box 255, Enterprise, AL 36330

**RECORDS**—tapes! Discounts to 73%; all labels; no purchase obligations; newsletter; discount dividend certificates; 100% guarantees. Free details. **DISCOUNT MUSIC CLUB**, 650 Main Street, PO Box 2000, Dept. 3-1282, New Rochelle, NY 10801

## REVERBERATION FOR ORGANS

Solid state with controls for reverberation and room size.

**EVERY ORGAN SHOULD OWN ONE.**

Send for free flyer—

DEVTRONIX ORGANS, INC.

6101 WAREHOUSE WAY

SACRAMENTO, CALIFORNIA 95826 Dept. B

## SYNTHESIZERS

**AMAZING** professional music synthesizer kits and plans. Polyphonic, duophonic, monophonic. Write **SYNTHLAB**, PO Box 4291, Helena, MT 59601

## COMPUTER EXPANSION

**TRS-80** model-I to 48K-RAM without expansion interface. Other enhancements for model I/III. Free details. **WGS CO.**, PO Box 7363, Bellevue, WA 98008

## BUSINESS OPPORTUNITIES

**LAWYER** Business litigation, patents, appeals. **JEROME FIELD**, B 292, Brooklyn 11230. Phone (212) 434-0781. Eves. 434-1825

**ATARI** repair business. Start your own. Send \$5.00 for more information to: **IRATA REPAIRS**, 2562 East Glade, Mesa AZ, 85204

**MECHANICALLY** inclined individuals desiring ownership of Small Electronics Manufacturing Business—without investment. Write: **BUSINESSES**, 92-R, Brighton 11th, Brooklyn, NY 11235

**MAKE** money selling electronics. Wholesale dealer catalog \$5.00 (redeemable). **ETCO**, Dept. 533, Box 840, Champlain, NY 12919

**MICROWAVE** receiver system. Write: "Dealers Wanted," Dept. REB, POB 4181, Scottsdale, AZ 85258 (602) 941-9395

**DEALERS** wanted: MATV/CATV, antennas, needles, films, free catalog. 212-897-0509. **D & WR**, 66-19 Booth, Flushing, NY 11374

"**USED TV's**"—Lucrative part or full time business in your home. Information on buying, selling, pricing. Many useful tips to get started. \$5.00. **BOX 19754**, Indianapolis, IN 46219

HIGHLY PROFITABLE

## ELECTRONIC FACTORY

Investment unnecessary, knowledge not required, sales handled by professionals. Ideal home business. Write today for facts!

Postcard will do, **Barta-RE-X**, Box 248, Walnut Creek, CA 94597.

## PICTURE TELEPHONE

**SEND** and receive video pictures over dial-up telephones with **Robot Picture Telephone**, seen in August through November 1982 Radio-Electronics. F.C.C. registered units available, kits, parts. Free brochure. **ROBOT RESEARCH**, 7591 Convoy Ct., San Diego, CA 92111. (714) 279-9430

## COMMUNICATIONS EQUIPMENT

**DECODE** Morse, Radioteletype signals from airwaves with **CODE\*STAR** reader. Kit \$169.95, wired \$229.95. Shipping \$5.00. **MICROCRAFT**, Box 513R, Thiensville, WI 53092, (414) 241-8144

## RF MODULATORS for the video industry

Satellite modulators from channel 2 thru UHF! Kits & assembled models for all microcomputers...including our new Apple-verter designed to mount inside computer. Also an extensive line of monitors, cameras and kits. **FREE CATALOG**

PHONE (402) 967-3771  
**ATV Research**  
13-RE BROADWAY  
DAKOTA CITY, NE 68731

## CB RADIO

**GET** more CB channels and range! Frequency expanders, boosters, speech processors, FM converters, PLL/slider tricks, how-to books, plans, modifications. Catalog \$2.00. **CB CITY**, Box 31500RE, Phoenix, AZ 85046

## REEL TO REEL TAPES

**TRUCKLOAD** sale, Ampex high quality open reel tape, 1800' or 2400' on 7" reels, used once, unboxed. Case of 40, \$45.00. Cassettes available. **VALTECH ELECTRONICS**, Box 6-RE, Richboro, PA 18954

## POWER SUPPLIES

**LABORATORY** quality 5-volt, 12-volt, tri-voltage supply for Op-Amps, IC's, Microprocessors. Kit \$69.95. Wired \$89.95. Shipping \$4.00. **MICROCRAFT**, Box 513R, Thiensville, WI 53092. (414) 241-8144

## TIMEX/SINCLAIR SOFTWARE

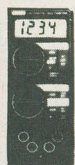
**ZX-81** and **TS1000** software cheap! Catalog plus two Christmas programs for \$1.00 and **SASE**: **FLORIDA CREATIONS**, RE1, Box 16422, Jacksonville, FL 32245

# DISCOUNT TEST EQUIPMENT

LOWEST PRICES AND IMMEDIATE DELIVERY FOR OVER 40 YEARS

### KEITHLEY

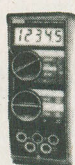
130



3 1/2 Digit • 5 Functions • 0.5% DCV Accuracy

\$122

135



4 1/2 Digit • 0.05% DCV Accuracy • 5 Functions

\$229

### B & K

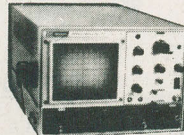
1405



5 MHz 3" Scope • 10mV/Division Vertical Sensitivity • More

\$285

1479BP

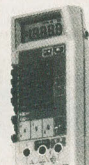


Dual Trace 30 MHz Triggered • 11.7nS Rise Time • 5mV/cm Vertical Sensitivity • Probes • More

\$882

### FLUKE

8024B



3 1/2 Digit • 11 Functions • 0.1% DC Accuracy • Safety Designed Test Leads

\$229

8062A



4 1/2 Digit • Full Functions And Ranges • True RMS to 30 kHz • 0.05% DC Accuracy

\$269

### BECKMAN

TECH 310



3 1/2 Digit • 7 Functions • 29 Ranges • 0.25% DC Accuracy

\$135

HD-100



3 1/2 Digit • 7 Functions • 29 Ranges • 0.25% DC Accuracy • Drop Proof • Water Proof

\$162

### LEADER

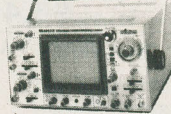
LBO 522



New Model • 20 MHz Dual Trace • 0.5 mV Sensitivity • More

\$740

LBO 524L



New Model • 35 MHz Dual Trace • 0.5 mV Sensitivity • More

\$1206

### HICKOCK

LX303



3 1/2 Digit • 19 Ranges And Functions • Auto Zero • 1% DC Accuracy

\$91

LX304



All Features of LX303 • Auto Decimal • Low Battery Indicator • Diode And Transistor Test

\$96

## WM. B. ALLEN SUPPLY

1601 Basin Street, New Orleans, LA 70116



Over 70,000 electronic items in stock for immediate delivery.



CALL TOLL FREE

**800 535-9593**

LOUISIANA TOLL FREE 800 462-9520



# ETCO<sup>TM</sup> AMERICA'S ELECTRONIC SUPERSTORE

VIDEO • TELEPHONE • ELECTRONICS • CABLE TV • PARTS

ETCO ELECTRONICS, PLATTSBURGH, N.Y. 12901 (518-561-8700)

**NEED MORE INFO?**  
CALL THE  
ETCO HI-TECH  
INFORMATION  
CENTER...  
1-514-342-1555  
9 A.M. - 5 P.M. EST

FANTASTIC MICROCOMPUTER CONTROLLED 60 CHANNEL  
WIRELESS REMOTE CONTROL CABLE TV CONVERTER WITH  
MORE FEATURES THAN ANY CONVERTER ON THE MARKET.

**\$189**

60 CHANNELS



It turns the set on/off, fine  
tunes the picture, tells the  
time, selects channels at ran-  
dom or in sequence, pre-sets any number of favorite channels,  
and pre-sets on/off times up to 24 hours ahead. 547ZA018

**VIDCOR 2000 CONVERTER ELIMINATES PROBLEMS WHEN  
TAPING FROM CABLE TV**



**89<sup>95</sup>**

Restores your VCR's  
capability for program-  
ming. Restores remote  
channel control Enables  
videotaping of one cable program while  
watching another. 547VA950

## MIDBAND BLOCK CONVERTERS

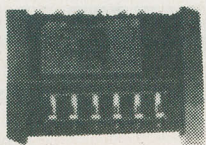


**39<sup>95</sup>**  
YOUR  
CHOICE

547VA277... Midband to  
lowband 3-channel.  
547VA276 Midband to  
highband 7-channel.

## NEAT VIDEO CONTROL CENTER

ONLY  
**49<sup>95</sup>**  
AT ETCO



Interconnects and operates  
up to 5 video components.  
Handles Cable TV, Games,  
VCRs, disc players, etc. Enables you to view TV while taping  
or dubbing. You'll think up other applications. 547VC689

## VCR/VTR SWITCH BOX

Kwik disconnect cables with "F"  
connectors - Very low insertion loss,  
because there are no switches. One  
time hook for VCR, TV, Game, Cable,  
etc. - Attractive brown & wood grain -  
Compact size: 6" x 4-1/2" D x 3" H.

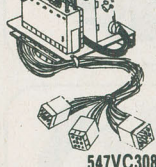
The easy & efficient method for mul-  
tiple connections for your VCR-TV-  
ANT/AUX-TV Game, etc. 547VC357

**29<sup>95</sup>**  
24.95 EA./5



NEW

## BRAND NEW FACTORY SURPLUS VHF/UHF VARAC- TOR TUNER ASSEMBLY



PRICE CUT **29<sup>95</sup>**

\* Admiral assembly No. NC 3143-1  
Tandem - side by side VHF and  
UHF tuners made originally for  
Admiral. Numbers that appear on  
the tuners are: 294-7829,  
8227AAFA, 94C725-2, 294-7831,  
8132AAFB.

547VC308

## FACTORY SURPLUS UHF TUNERS

Brand new production sur-  
plus. All solid state. Ideal for  
experimental work building  
cable TV converters, etc.  
547SU099

547VA966... As above with  
detent... 4.99  
547SU285... Solid state VHF  
tuners... 5.95

## VHF/FM 75 OHM TO 300 OHM MATCHING TRANSFORMERS

Very popular. Use to  
couple and match cable  
TV to TV set. Also couples VCR machi-  
nes, TV games etc. 5-300MHz 547AE380

547AE385... rugged out-  
door version... \$2.29, \$1.95 ea./5  
547AE152... with built in  
CB interference filter... \$1.95, \$1.75 EA./5

## THE AMAZING 60 CHANNEL JERROLD 400 WIRELESS CABLE TV CONVERTER

DEALERS WANTED

ONLY  
**169<sup>95</sup>**  
159.95 EA./5



Change channels, turn your set on or off, or even fine tune  
without leaving your comfortable viewing position. Channel 3 out-  
put. 547ZA017

## HOT NEW 35 CHANNEL REMOTE CONTROL CABLE TV CONVERTER



ONLY  
**89<sup>95</sup>**  
74.95 EA./10  
79.95 EA./5

Includes remote TV on/off switch and  
fine tuning control. 20 FT control cable.  
547VB553

DEALERS  
WANTED!

## VIDEO LOCK NEW!



**19<sup>95</sup>**

The new easy-to-use, easy-to-install, selective locking A/B  
switch system that permits parental control over regular TV pro-  
gramming, pay-TV, cable TV, video tapes or video discs.  
547VB345

**INCREDIBLE ETCO COPYGUARD STABILIZER  
AND VIDEO IMAGE ENHANCER SELLS AT A  
PRICE BELOW WHAT YOU WOULD PAY FOR  
EITHER UNIT IF PURCHASED SEPARATELY!**



ONLY  
**99<sup>95</sup>**  
AT ETCO

An ETCO exclusive! Combines both instruments in  
one. It works like a charm! Try one on our 30 day  
money back guarantee!

DEALERS WANTED

DELIVERY HANDLING & INSURANCE CHARGES  
Find the total amount of your order and your zip code  
below.

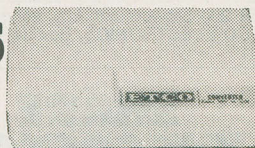
	01000 to 28999	29000 to 67999	68000 to 99999
If Your Order Totals			
Up to \$20.00	2.47	2.99	3.78
\$20.01 to \$30.00	2.99	3.52	4.41
\$30.01 to \$40.00	3.99	4.62	5.78
\$40.01 to \$50.00	5.46	6.51	7.77
\$50.01 to \$90.00	7.25	8.61	10.81
Over \$90.00	8.92	10.39	13.55

Check with order, please. Visa & Mastercard O.K.  
(Sorry, no C.O.D's). N.Y. state residents add 7%  
sales tax. Dealer & Export inquiries invited. Our tele-  
phone order desk never closes.

## SMASHING ALL SALES RECORDS OUR NEW 30 CHANNEL CABLE TV CONVERTER

**39<sup>95</sup>**

\$34.50 EA./5



547AE047

Converts mid & super band cable chan-  
nels for viewing on your TV set!

## THE ETCO MICRO 1000 36 CHANNEL VCR PROGRAMMER AND CABLE TV CONVERTER



NEW!  
**69<sup>95</sup>**

Equivalent to or better than: Vidcor 2000, Philips CTC-2, Magna-  
vox MX-40CC, Lindsay V2U, Rhoades CO-500, Philips CTC-30,  
Winegard VC-7600 and others... 547VB114

As above - with Vernier tuning: adjustable tuning insures  
total tracking compatibility with all TV sets. 547VC477... 79.95

## PHILIPS VIDEO CONTROL CENTER

NEW!  
**59<sup>95</sup>**



Neat low loss switching unit selectively feeds 6 different video  
sources to your TV set. Also possible to watch one source while  
viewing another 547ZA045

**TV/FM SIGNAL BOOSTER FOR  
CABLE OR OFF AIR USE**  
improves TV and FM by resto-  
ring signal loss which hap-  
pens during basic VCR instal-  
lations and multiple set instal-  
lations. 75 ohm. 547VA103 **19<sup>95</sup>**  
17.95 EA./5

## MORE CABLE TV BARGAINS

547VA964... defective "as-is" VHF/UHF block converters. "U-  
Fix" \$14.95  
547VB341... OAK V26 factory rebuilt cable converters... \$59.95  
547VA991... Lindsay V2-U VHF/UHF block converters (brand  
new) \$49.95  
547VC931... RCA 36 channel set top converter. Used.  
Guaranteed \$59.95  
547VC930... OAK RT35 (jewel box) 36 channel remote (used-  
guaranteed) \$69.95  
547VB359... OAK L35 set top 35 channel converter (used-  
guaranteed) \$89.95  
547VA963... Used (as-is) OAK V26 26 channel cable TV  
converters \$39.95  
547VA995... Used (as-is) TOCOM DC1000 remote control 20 chan-  
nel converter \$29.95

ETCO Electronics  
Dept 551  
Plattsburgh, N.Y. 12901

Send my free ETCO Catalog now.  
I am not currently receiving your catalog.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
State \_\_\_\_\_ City \_\_\_\_\_ ZIP \_\_\_\_\_

FREE  
CATALOG



## PLANS & KITS

**PRINTED** circuit boards from sketch or artwork. Kit projects. Free details. **DANOCINTHS INC.**, Box 261, Westland, MI 48185

**CABLE TV** converters and equipment. Plans and parts. Build or buy. For information send \$2.00. **C & D ELECTRONICS**, PO Box 21, Jenison, MI 49428

**SAVE** steps, money. Use your telephones as an intercom. Plans \$5.00. **dB ENTERPRISES**, Box 453R, Westwood, NJ 07675

**METAL detectors**, psycho acoustic sound generators, I.C. timed house light switches, electronic fish lures, etc. Kit catalog—\$1.00. **FREELANCE ELECTRONICS**, PO Box 10004, Ogden, UT 84409

**MICROWAVE television "downconverters."** Exclusive new five stage design. Easily assembled. Catalogue: \$2.00 (refundable). **NDS**, Box 12652-R, Dallas, 75225

**OVER 200** projects and kits, send stamp for list. **MATCO ELECTRONICS**, Box 316R, Cadillac, MI 49601

**SHARE  
THE COST OF  
LIVING.**

**GIVE TO THE  
AMERICAN CANCER SOCIETY.**

**4** one in kit • **CAPACITANCE METER** 1pF to 999Kuf • **FREQUENCY COUNTER** 35MHz • **SQUARE WAVE GEN.** 1Hz to 99KHz • **OHMMETER**—3.58MHz Xtal—Regulated PS—Five .8" Readouts—Low cost TTL Circuits—Automatic Decimal Placement—Be AMAZED—Build it for \$60 or less. [Purchase the plans, drilled P.C. board 4-3/4" by 6-3/4" and front panel decal for \$21.79] **BAGNALL ELECTRONICS**, Refund—179 May Street, Fairfield, Conn. 06430

**SINE** wave decoder reference manual includes theory, alignment, antenna hook-up, trouble shooting, improvements. \$15.00. **SIGNAL**, Box 2512-R, Culver City, CA 90230

**PROFESSIONAL Electronic devices plans, kits**, P.C. circuitry, famous drop-in microphone cartridge, debugging equipment, more items available. For information send \$2.00. **MOUNTAIN ELECTRONICS**, R. 2, Box 186A, Charlotte, TN 37036

**ORDER** it yourself, 2K 4K EPROM computer chip copier. Build for less than \$30.00. Plans \$15.95. For more details send SASE and \$1.00 to: **EARTH CORP.**, 5503-1 Autumn Woods, Trot, OH 45426

## SUBSCRIPTION TV KITS

**UHF Gated Pulse Kit.....\$39.00**  
**UHF Sinewave Kit.....\$37.00**  
**Special Both Kits.....\$59.00**  
**Informative Catalog.....\$ 2.00**

Kits include all parts, manual and an etched & drilled PC board. Send for our "Informative Catalog" and find out what type you need.

**J & W ELECTRONICS, INC.**

**P. O. BOX 61-B**

**CUMBERLAND, RI. 02864**

**APPLE builders**—send stamp for our flyer of Apple parts. IC sets, ROM sets, connectors, Shugart to Apple modification kits, etc. **ELECTROVALUE INDUSTRIAL INC.**, Box 157-R, Morris Plains, NJ 07950

**FREE 1982** catalog. Components, kits, PC-board material, enclosures. **HAUCK ELECTRONICS**, 1928 Fairacres Ave., Pgh, PA 15216

**PC boards** from your artwork. Prototypes. No minimums. Quantity discounts. Free details. Write: **TECH CIRCUITS**, Dept. 6, PO Box 4471, Cleveland, TN 37311

**NEW: single board controller** based on Z8671. Write **H.H.S. MICROCONTROLLERS**, 5876 Old State Road, Edinboro, PA 16412

**HELP** is here! The Radio Electronics Buyers' Guide lists thousands of electronic, radio, microwave, antenna, and mechanical parts, along with who sells them by retail mail order to hobbyists. Over 50 suppliers included, with address and phone number of each so you can contact them immediately. \$3.95 ppd. **HALLWARD PRODUCTS**, 39 Sunset Ct., Dept. 2, St. Louis, MO 63121

**SUPER SAVINGS** on electronic components, exciting kits, great variety of IC's, free catalog. **MERCANTILE ELECTRONICS**, Box 2503, Hialeah, FL 33012

**GET** lab grade information from your oscilloscope. Unique project adds single sweep, delayed sweep, video sync separator to any triggered sweep scope. Plans \$6.95. 12" B&W video monitor \$89.95. Direct video conversion kit for Sinclair ZX-81/TS1000 \$9.95. Information \$2.00, refundable. **RANDOM ACCESS**, Box 41770R, Phoenix, AZ 85080

## FREE KIT Catalog

**FUNCTION GENERATOR KIT** \$59.95  
**Auto-Ranging Cap-meter kit** \$79.95

**Phone 415-447-3433**

Write or Phone for **FREE CATALOG**.  
Average 1 minute Saturday call is 21¢.

**DAGE** **SCIENTIFIC INSTRUMENTS**  
**BOX 1054R LIVERMORE CA 94550**



## ELECTRONIC ORGAN KITS

**3-4 Manuals**

**THEATER and CLASSICAL**

**Refundable**

**Parts**

**Brochure \$2.00**

**Catalog \$2.00**

**DEVTRONIX ORGANS, INC.**, Dept 60  
6101 WAREHOUSE WAY, SACRAMENTO, CA 95826

# CEI Consolidated Electronics, Inc

## CASSETTE HEAD CLEANER

- Wet Type Cleaner
- Includes Cleaning Solution
- Same as Major Manufacturer



**PART NO.  
CE 390**

**\$3.89**  
(1-9)

**\$3.55**  
(10 & up)

## ARIA CASSETTE TAPES

- 1 Year Warranty
- High Quality, Low Price
- Box of 10 folds into Counter Display



**PART NO.  
CE 369**

**\$1.39**  
(1-9)

**\$1.19**  
(10 & up)

## CEI 2010

- .7 mil conical stylus
- Response: 20 Hz-20kHz
- Tracking: 2-3 gms
- Output: 4.8 mV

**\$7.50**  
(1-9)

**\$6.75**  
(10 & up)



## CEI 2011E

- .4x.7 mil elliptical stylus
- Response: 15Hz-20 kHz
- Tracking: 1 1/2-2 1/2 gms
- Output: 4.8 mV

**\$10.75**  
(1-9)

**\$9.75**  
(10 & up)



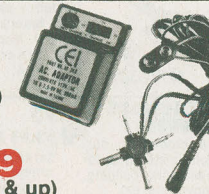
## AC ADAPTOR

Converts 120 VAC to 6, 7.5, and 9 VDC at 300 mA.

**PART NO.  
AC-453**

**\$3.99**  
(1-9)

**\$3.59**  
(10 & up)



**\$10 MINIMUM ORDER**

**1-800-543-3568**

**NATIONAL**



**1-800-762-3412**

**IN OHIO**

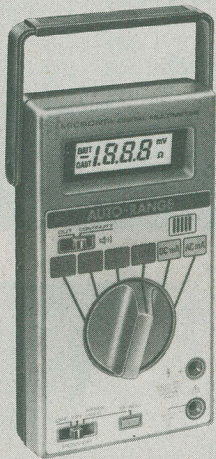
**CALL FOR YOUR FREE CURRENT CATALOG**



# THE SHACK® HAS WHAT YOU NEED FOR HOLIDAY PROJECTS

## Plus Great Electronic Gifts for Everyone—Visit Us Today

### Autoranging DVM

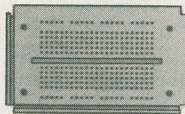


**NEW!**  
**8995**

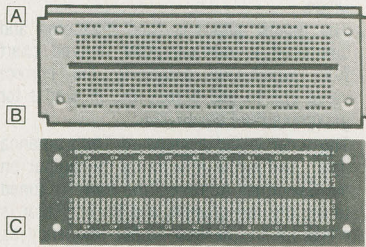
- Tests Forward Conduction of Diodes and Transistors
- Selectable "Range-Hold" Circuitry Eliminates Undesired Switching to the Next Range

**Microtronic® 3 1/2-Digit LCD DVM.** Our best—the multimeter that "thinks"! Choose the function and it selects and displays the correct range automatically. Big liquid-crystal display, "beep" continuity and range-change indicator. Measures to 1000VDC, 500VAC, 200mA (both AC and DC), 2 megs resistance with super-accurate low-resistance readings. 6 3/8 x 3 1/2 x 1 3/8". With test leads, spare fuse. Requires two "AA" batteries. 22-192 ..... 89.95

### A Better Way to Build!



Design and Debug Your Circuit on a Socket. Transfer It to Matching PC Board—It's Easy!

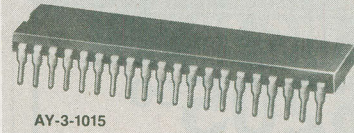


**A Experimenter's PC Board.** Layout matches that of sockets (below) for quick and easy transfer of your finalized circuit. Features 550 pre-drilled connection points. 2 1/16 x 5 7/16 x 1 1/16". 276-170 ..... 3.29

**B Modular IC Breadboard Socket.** These "breadboards" together horizontally or vertically. Silver-nickel contacts accept 30 to 22-gauge solid wire. Features two bus strips, 550 indexed connection points. 2 1/8 x 6". 276-174 ..... 11.95

**C Modular IC Breadboard Socket.** Smaller version of above has two bus strips, 270 indexed connection points. 2 1/8 x 3 5/8". 276-175 ..... 6.95

### Computer Communication



Four NEW ICs

**179**

AY-3-1015

Low As

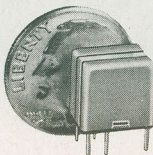
**Single-Supply UART. AY-3-1015.** Full-duplex universal transceiver accepts asynchronous serial binary characters and converts to a parallel format, and vice versa. Selectable baud rate, number of data bits per character, stop bits and parity mode. Fully buffered outputs. Low power. 4.75-5.25VDC. 40-pin with specs and data. 276-1794 ..... 5.95

**RS232 Quad Line Driver. 1488.** Interfaces data terminal equipment with data communications devices. Can interconnect different logic families. Protected, current-limited output. Split supply, 15VDC maximum. 14-pin with data. 276-2520 ..... 1.79

**RS232 Quad Line Receiver. 1489.** Use with above. Will perform logic level translation. Sections can be paralleled to obtain multiple outputs. Input signal range  $\pm 30V$ . Built-in input threshold hysteresis. Single supply, 10VDC maximum. 14-pin with data. 276-2521 ..... 1.79

**Dual Peripheral Driver. SN75446.** Can take a logic-level signal and drive a relay, solenoid or other device directly, up to 350 milliamps, 50VDC. TTL/MOS compatible, diode-clamped inputs. Single 5.5VDC supply. 8-pin with data. 276-2530 ..... 2.79

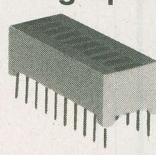
### Micro 5V Relay



**249**  
Actual Size!

Just 1 1/32 x 3/8 x 1/4"! SPDT contacts: 1 amp at 125VAC. 55-ohm, 90 mA coil. .100" centers. 275-240 ..... 2.49

### Bargraph Display



**NEW!**  
**399**

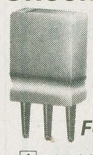
**MV53164.** Easy way to add metering to your circuits! 10 efficient yellow LEDs in 20-pin DIP. 276-082 ..... 3.99

### Synthesizer IC



**NEW!** 16-Pin With Data  
**SN94281.** Add controls and a speaker to produce amazing "arcade" sounds. Kids just love it! 276-1767 ..... 2.49

### Check These RF/IF Bargains



**NEW!**  
**99¢**

Pkg. of 2

**NEW!**  
**159**

Pkg. of 2

For Receiver Projects, BFOs

**A 455 kHz Ceramic Filters. SFU 455-A.** 10 kHz bandwidth. 272-1302 ..... Pkg. 2/99¢  
**B 5-60 pF Trimmer Capacitors.** PC mount, slot adjust. 272-1340 ..... Pkg. 2/1.59

### Panel Lettering



**NEW!**  
**259**

Four sheets of rub-on letters, symbols, numbers and calibration marks.

270-201 ..... 2.59

### Joystick Pots

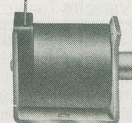
**495** Each

For computers, radio-control models, more. Quality linear-taper controls. 1" shaft.



Ohms	Cat. No.	Each
40k	271-1706	4.95
100k	271-1705	4.95

### 12VDC Solenoid



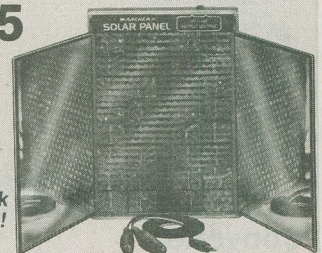
**NEW!**  
**399**

1 1/8 x 1 1/16 x 1 1/16"  
Plunger pulls in 1/8", holds up to 1/4 lb. For robotics, model railroads, opening valves, more. 31-ohm, 430 mA coil. 273-251 ..... 3.99

### Portable Solar Panel

**2495**

**NEW!**  
**Radio Shack EXCLUSIVE!**



• 6 or 12VDC Output • 32 Full-Spec Cells

Ready-to-use panel of polycrystalline cells turns you on to the "free" electrical power that's available every sunny day! Ideal for charging nickel-cadmium batteries. Will also power radios, calculators, toys and many other small devices directly from ol' sol. Usable output with full sun is approximately 1/2 watt: 80 milliamps at 6V, 40 mA at 12V. Special lens and detachable 5 x 4" reflector panels allow maximum collection with minimum repositioning. 48" plug-in lead with clips. 5 3/4 x 4 1/8 x 5/8". Not for permanent outdoor installation. 277-1250 ..... 24.95

### AC Outlet Tester

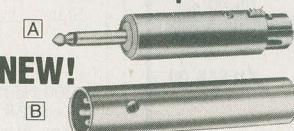


**595**  
Play It SAFE!

Neon read-out warns you if a 120VAC, 3-wire outlet or extension cord is faulty.

22-101 ..... 5.95

### XLR Adapters

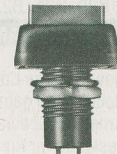


**NEW!**

**Built-In Transformers**

**A** Adapts mikes having A3M connector to 1/4" input jack. 274-016 ..... 9.95  
**B** Adapts high-Z mikes to XLR input. 274-017 ..... 8.95

### Push Switches



**NEW!**  
Low As  
**119**

"Soft-Feel" SPST Push-On/ Push-Off. 3A at 125VAC. 1 x 3/4 x 9/16". 3/8" mtg. hole. 275-1565 ..... 1.29  
Momentary. 275-1566 ..... 1.19

# Radio Shack®

A DIVISION OF TANDY CORPORATION • OVER 8500 LOCATIONS WORLDWIDE

Retail prices may vary at individual stores and dealers

CIRCLE 50 ON FREE INFORMATION CARD



# SPARTAN Electronics Inc.



CALL MAIL  
(516) 499-9500  
6094 Jericho Tpke.  
Commack, N.Y. 11725

**VIC-20**  
**\$205<sup>00</sup>**

Vic 20 Personal Computer	205.00
Vic 1540 Single Disk Drive	349.00
Datassette Cassette I/O Unit	69.00
Vic 1515 Graphic Printer	349.00
Vic Super Expander	65.00
3K Ram Cartridge	34.25
8K Ram Cartridge	55.00
16K Ram Cartridge	115.00
Vic IEEE-488 Interface	79.00
Vic RS-232C Terminal Interface	79.00
Vic RS-232C Terminal Interface	39.00
Vic Modem	100.00
6-slot Expander	115.00

## VIDEO ACCESSORIES

2 set coupler	2.95
3 set coupler	3.95
4 set coupler	4.50
F Connectors	.25
Matching transformer	.99
TV Game Switch	3.95
VHF-UHF AMP-28DB	29.95

## 13" BMC COLOR MONITOR

Composite Video sound  
**\$299**



## DELUXE 40 CHANNEL VHF to UHF Block Converter \$38.95 ea.



Features accessible fine tuning knob included: matching X former and two cables

## Control Data Disks

per box 12  
SSSD

**\$23.95**

## Refurbished Monitors

12" diagonal  
**39.95**



## ATARI

410 Program Recorder	79.00
810 Disk Drive	439.00
850 Interface Module	169.00
Epson cable for 850 module	34.00
Atari Joysticks (pair)	20.00
32K module	99.95
Atari 16K Module by Microtek	69.00
Atari 800 (16K)	659.00
Atari 400 (16K)	279.00
VisiCalc for Atari (Disk)	185.00
Pac-Man (cartridge)	34.50
Centipede (cartridge)	34.50
Asteroids (cartridge)	34.50
Missile Command (cartridge)	34.50
Star Raiders (cartridge)	39.50
Space Invaders (cartridge)	34.50
Caverns of Mars (disk)	34.50
Assembler/Editor (cartridge)	49.50

We carry all ATARI software and hardware.

## 42 Channel Remote CATV Converter

w/on/off Fine Tuning  
**\$94.95**



## 40 Channel VHF to UHF Block Converter



**28.95 Ea.**  
**24.95 4 & up**

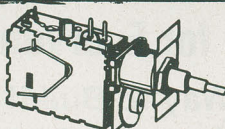
## Volume Discounts

Min. Order \$25.00	to 75.00	\$2.50
International shipping Add'l.	76.00 to 250.00	\$4.50
Prices subject to change without notice.	251.00 to 500.00	\$6.00
COD 2.00 Extra	501.00 to 750.00	\$8.50
*Add'l. shipping for monitors	751.00 to 1000.00	\$12.00
	Over 1000.00	\$12.50

• Visa, MC, BAC, Amex, Check  
COD, Money Order  
Add For Shipping\*

(516) Mon Th Tu W F Sa  
499-9500 9-8 9-6 9:30-5

## MORE GAIN THAN A VARACTOR UHF TUNER



## SATISFACTION GUARANTEED \$15.00

Freq. Range UHF470-889MHz Channels 14-83  
Output Channel 3.  
Available on request: Ch 2 or 4.

Part No. B20

Modified High Gain Tuner. . . . . **\$15.00**

1. The first thing we do is change the standard diode found in every tuner to a Hot Carrier Diode.
2. The tuners output is then measured and compared to our computer derived chart from which we determine the correct value coil to add across the IF output for maximum Pre-Peaked gain.
3. The tuner is fed a standard 10db antenna input, and while monitoring the output on our Spectrum Analyzer, the tuner is tuned to the desired channel and its oscillator is offset for the desired output frequency as follows:

Ch. 2:58Mhz Ch. 3: 63Mhz Ch. 4: 68Mhz

We call this step peaking because the tuners output looks like a peak on our spectrum analyzer and the highest point of that peak is actually adjusted for the desired output.

4. Finally, we measure the tuners output one more time which is again compared to our computer derived performance chart to ascertain the correct value of the second coil which is added to the tuners internal connections.

This procedure was developed by GILCO and its our computer derived performance charts that make our tuner better. That's because almost every tuner gets a different value coil before it's peaked and then a different value coil after it's peaked. The combinations are endless and the way we determine the values is our secret.

## PRINTED CIRCUIT BOARDS

Part No. B21 Printed Circuit Board. . . . **\$17.00**

1. This Printed Circuit Board uses only one jumper, others use 9.
2. The component layout is screen printed on the Component side of the pre-drilled P/C Board.
3. The solder side of the P/C Board is covered with High Temperature Solder Resist for ease of assembly.
4. This P/C board was designed to take advantage of the Gilco High Gain Tuner which means its circuitry is simpler and more efficient than those circuits that require inferior Varactor Tuners.

## ELECTRONIC PARTS KITS

Part No. B22 Complete Parts Kit. . . . **\$80.00**

All resistors (30), Potentiometers (1-5K, 3-10K), Panel Mount Potentiometer (10K), Electrolytic Capacitors (6), Ceramic and Mylar Disc Capacitors (35), Variable Capacitors (4), All Integrated Circuits (7), Voltage Regulator, Heat Sink, Diodes (4), IC Sockets (4-8 pin, 3-14 pin), Power Transformer (24V/1A), Coil Kit with No. 26 wire (4), Speaker (4"-3 Oz.), Standoffs, Coaxial cable, All misc. Hardware, etc. All parts are individually packaged and labeled.

All components including the wire, Hardware, Coaxial Cable and heat sinks are included in the parts kit. This means your assembly time from start to finish is only 4 hours.

Order all 3, B20, B21, B22. . . . . **110.00**

Order 5 each, B20, B21, B22. . . . . **95.00/set**

## ACCESSORIES: AMPLIFIERS

Part No.

A02 New 2 Stage Low Noise 28db gain RF Amplifier Specially designed for kit builders **Kit \$18.00**

A03 New 1 Stage Low Noise 14db gain Amplifier **Kit \$10.50**

A04 75-300 OHM matching Transformer. **\$1.00**

F59 Coaxial Connectors. . . . **.30**

Mail order only. Send check or money order to:

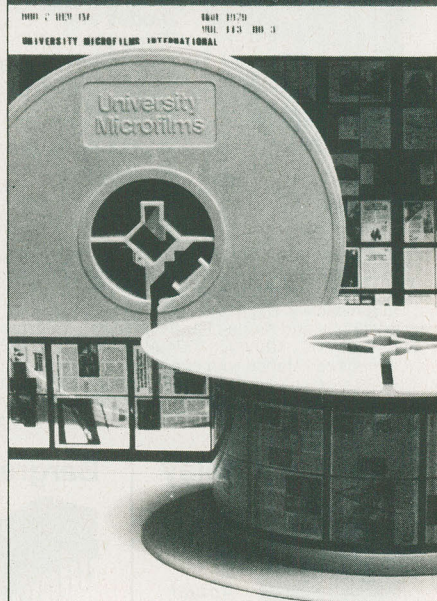
**GILCO INTERNATIONAL, INC.**

P. O. Box 8817, Coral Gables, FL 33124

Tel. (305) 823-5891 For COD orders add 10% shipping and handling or for orders over \$50, add 5%.

FL residents add 5% sales tax. Please write for more information

This publication is available in microform.



## University Microfilms International

Please send additional information for \_\_\_\_\_

Name \_\_\_\_\_

Institution \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

300 North Zeeb Road Dept. P.R.  
Ann Arbor, Mi. 48106 U.S.A.

30-32 Mortimer Street Dept. P.R.  
London WIN 7RA England



# DoKay Computer Products, Inc.

VISIT OUR RETAIL STORE  
AND RECEIVE A 5% DISCOUNT!

3250 KELLER STREET, #9 • SANTA CLARA, CA 95050

## 8000

8035	6.95	8239	4.75
8039	7.59	8243	4.75
8080A	3.90	8250	14.90
8085A	7.95	8251	4.50
8088	34.95	8253	8.75
8155	7.75	8253-5	9.75
8156	8.75	8255	4.50
8185	29.00	8255-5	5.20
8741	39.00	8257	8.50
8748	14.95	8259	6.85
8755	29.95	8272	39.00
8202	27.95	8275	29.00
8205	3.45	8279	9.25
8212	1.80	8279-5	9.95
8214	3.75	8282	6.50
8216	1.75	8283	6.50
8224	2.45	8284	5.50
8226	1.80	8286	6.50
8228	4.50	8287	6.50
8237	19.00	8288	25.00
8238	4.75	8289	49.00

## 16K APPLE RAM CARD

Upgrade your 48K Apple II  
to full 64K

BARE BOARD	14.00
KIT	39.90
ASSEMBLED & TESTED	45.00

## LEDS

Jumbo Red	10/1.00
Jumbo Green	6/1.00
Jumbo Yellow	6/1.00

## CONNECTORS

RS 232	Male	3.00
RS 232	Female	3.50
RS 232	Hood	1.20

## 6500

6502	5.49
6502A	9.45
6504	6.90
6505	7.65
6507	9.90
6520	4.35
6522	7.95
6532	9.95
6551	11.75

## EPROMS

1702	(1ns)	3.00
2708	(45ns)	2.99
2716	(5v 45ns)	3.49
2716-1	(5v 35ns)	7.85
2532	(5v 45ns)	7.85
2732	(5v 45ns)	6.49
2764	(5v 45ns)	Call

## DYNAMIC RAMS

4027	(250ns)	2.00
4116	(200ns)	1.25
4116	(150ns)	1.75
4164	(200ns)	Call

## STATIC RAMS

2101	(450ns)	1.85
21L02	(250ns LP)	1.55
2111	(450ns)	2.49
2114	(450ns)	1.75
2114L-3	(300ns LP)	1.85
2114L-2	(200ns LP)	1.95
TMM2016	(200ns)	5.49
TMM2016	(150ns)	6.49
TMM2016	(100ns)	7.49
HM6116	(200ns)	Call
HM6116	(150ns)	Call
HM6116	(120ns)	Call

LP = Low Power

## Z80

Z80 A	CPU	4.95
Z80 A	PIO	4.95
Z80 A	CTC	6.95

Call for Complete List

## MICROPROCESSOR

## REAL-TIME CLOCK

MSM 5832

6.90

**WE WILL BEAT  
ANY COMPETITOR'S  
PRICES!**  
Call before you buy

## CRYSTALS

32.768 KHZ	1.90	5.185	3.90
1.0 MHZ	4.50	5.7143	3.90
1.8432	4.50	6.5536	3.90
2.0	3.90	8.0	3.00
2.097152	3.90	10.0	3.00
2.4576	3.90	14.31818	3.90
3.2768	3.90	18.0	3.00
3.579545	3.00	18.432	3.00
4.0	3.00	20.0	3.00
5.0	3.00	22.1184	3.00
5.0688	3.90	32.0	3.90

## 74LS00 SERIES

74LS00	.24	74LS123	.95	74LS253	.80
74LS01	.24	74LS124	2.90	74LS257	.80
74LS02	.24	74LS125	.95	74LS258	.80
74LS03	.24	74LS126	.79	74LS259	2.80
74LS04	.24	74LS132	.75	74LS260	.60
74LS05	.24	74LS136	.49	74LS266	.49
74LS08	.24	74LS137	.95	74LS273	1.60
74LS10	.24	74LS138	.75	74LS275	3.25
74LS11	.30	74LS139	.75	74LS279	.49
74LS12	.30	74LS145	1.10	74LS280	1.95
74LS13	.40	74LS147	2.20	74LS283	.95
74LS14	.89	74LS148	1.20	74LS290	1.20
74LS15	.30	74LS151	.75	74LS293	1.79
74LS20	.24	74LS153	.75	74LS295	.99
74LS21	.30	74LS154	1.75	74LS298	.99
74LS22	.24	74LS155	.89	74LS324	1.75
74LS26	.30	74LS156	.89	74LS352	1.49
74LS27	.24	74LS157	.75	74LS353	1.49
74LS28	.30	74LS158	.75	74LS363	1.49
74LS30	.24	74LS160	.95	74LS364	1.95
74LS32	.36	74LS161	.95	74LS365	.89
74LS33	.55	74LS162	.95	74LS366	.89
74LS37	.55	74LS163	.95	74LS367	.69
74LS38	.35	74LS164	.95	74LS368	.69
74LS40	.30	74LS165	.95	74LS373	.99
74LS42	.49	74LS166	1.95	74LS374	1.69
74LS47	.75	74LS168	1.69	74LS377	1.40
74LS48	.75	74LS169	1.69	74LS378	1.15
74LS49	.75	74LS170	1.69	74LS379	1.35
74LS51	.30	74LS173	.75	74LS385	1.89
74LS54	.35	74LS174	.89	74LS386	.59
74LS55	.35	74LS175	.89	74LS390	1.79
74LS56	1.20	74LS181	1.99	74LS393	1.79
74LS73	.39	74LS189	9.50	74LS395	1.59
74LS74	.44	74LS190	.89	74LS399	1.59
74LS75	.49	74LS191	.89	74LS424	2.89
74LS76	.39	74LS192	.89	74LS447	.75
74LS78	.49	74LS193	.89	74LS490	1.89
74LS83	.75	74LS194	.89	74LS668	1.65
74LS85	.95	74LS195	.89	74LS669	1.85
74LS86	.39	74LS196	.79	74LS670	2.10
74LS90	.65	74LS197	.79	74LS674	9.50
74LS91	.79	74LS221	1.10	74LS682	2.99
74LS92	.65	74LS240	.95	74LS683	2.39
74LS93	.59	74LS241	.95	74LS684	2.39
74LS95	.79	74LS242	1.79	74LS685	2.39
74LS96	.79	74LS243	.95	74LS688	2.39
74LS107	.39	74LS244	.95	74LS689	2.39
74LS109	.39	74LS245	1.89		
74LS112	.39	74LS247	.79	81LS95	1.65
74LS113	.39	74LS248	1.20	81LS96	1.65
74LS114	.49	74LS249	.89	81LS97	1.65
74LS116	.49	74LS251	1.25	81LS98	1.65

## Disc Controller

1771	16.00
1791	27.95
1793	29.95
1795	49.95
1797	49.95

## Interface

8T26	1.65
8T28	1.95
8T95	.95
8T96	.95
8T97	.95
8T98	.95
DM8131	2.90
DS8836	1.25

## IC Sockets ST W/W

8 PIN	.10	.49
14 PIN	.12	.50
16 PIN	.15	.57
18 PIN	.20	.85
20 PIN	.25	.99
22 PIN	.25	1.30
24 PIN	.25	1.40
28 PIN	.35	1.50
40 PIN	.40	1.80

ST = Soldertail  
W/W = Wirewrap

## LINEAR

LM301	.32	LM741	.29
LM308	.75	LM747	.75
LM309K	1.25	LM748	.49
LM311	.64	LM1310	2.45
LM317T	1.65	MC1330	1.69
LM317K	1.70	MC1350	1.25
LM318	1.49	MC1358	1.69
LM323K	3.75	LM1414	1.49
LM324	.59	LM1458	.55
LM337K	3.90	LM1488	.95
LM339	.79	LM1489	.95
LM377	2.25	LM1800	2.45
LM380	1.25	LM1889	2.45
LM386	1.00	LM3900	.59
LM555	.38	LM3909	.95
LM556	.65	LM3914	3.70
LM565	.95	LM3915	3.70
LM566	1.45	LM3916	3.70
LM567	.99	75451	.35
LM723	.49	75452	.35
LM733	.95	75453	.35

## CMOS

4000	.25	4017	1.15	4082	.30
4001	.30	4018	.90	4085	.90
4002	.30	4019	.45	4086	.90
4006	.90	4020	.90	4093	.90
4007	.25	4021	.90	4098	2.49
4008	.90	4022	1.10	4099	1.90
4009	.45	4023	.35	4502	.90
4010	.45	4024	.75	4503	.60
4011	.30	4025	.35	4508	1.90
4012	.30	4026	1.60	4510	.90
4013	.45	4027	.60	4511	.90
4014	.90	4028	.75	4512	.90
4015	.90	4029	.90	4514	1.20
4016	.45	4030	.45	4515	2.20
		4034	2.90	4516	1.50
		4035	.85	4518	1.20
		4040	.90	4519	1.20
		4041	1.20	4520	1.20
		4042	.75	4522	1.20
		4043	.75	4526	1.20
		4044	.75	4527	1.90
		4046	.90	4528	1.20
		4047	.90	4531	.90
		4049	.50	4532	1.90
		4050	.50	4538	1.90
		4015	.90	4539	1.90
		4053	.90	4543	2.70
		4060	1.39	4555	.90
		4066	.75	4556	.90
		4068	.39	4581	1.90
		4069	.30	4582	1.90
		4070	.35	4584	.90
		4071	.30	4585	.90
		4072	.30		
		4073	.30	80C07	.90
		4075	.30	80C95	.90
		4076	.90	80C96	.90
		4078	.30	80C97	.90
		4081	.30	80C98	1.15

**DoKay Computer Products, Inc.**  
3250 Keller Street, #9  
Santa Clara, CA 95050  
(800) 538-8800  
Local Calif. Residents (408) 988-0697

STORE HOURS:  
MON-FRI 8:30 A.M.-6:00 P.M.  
SAT 10:00 A.M.-3:00 P.M.



TERMS: For shipping include \$2.00 for UPS Ground. \$3.00 for UPS Blue Label Air. \$10.00 minimum order. Bay Area residents add 6% Sales Tax. California residents add 6% Sales Tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Send SASE for complete list.





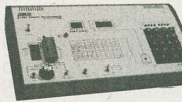


## 2708, 2716, 2732 & 2764 EPROM Programmer

### JE664 EPROM PROGRAMMER

8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES  
Self-Contained — Requires No Additional Systems for Operation

**NEW!**



• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer Interface for editing/program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, ±10W power consumption • Enclosure: Color-coordinated, light tan panels w/molded moisture bond end pieces • Size: 15-5/8" L x 8-3/4" W x 3-1/4" H • Wt.: 5 1/2 lbs.

**JE664-A EPROM Programmer** ..... \$995.00  
Assembled & Tested (Includes JIM6A Module)

**JE665 — RS232C INTERFACE OPTION** — The JE665 RS232C Interface Option implements computer access to the JE664-A RAM. Sample software written in BASIC provided for TRS-80 Model I, Level II Computer. Baud rate: 9600. Word length: 8 bits • odd parity. Stop bits: 2. Option may be adapted to other computers.

**JE664-ARS EPROM Prog. w/JE665 Option** ..... \$1195.00  
Assembled & Tested (Includes JIM6A Module)

### EPROM JUMPER MODULES

The JE664-A JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming gates to the EPROM & configures EPROM socket connections for that particular EPROM.

Part No.	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Motorola, National, Intel, TI	\$14.95
JM16A	2716, TMS2516	Intel, Motorola, National, NEC, TI	\$14.95
JM18B	TMS2716	Motorola, TI (+5, -12, +12)	\$14.95
JM32A	TMS2532	Motorola, TI (+5, -12, +12)	\$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel	\$14.95
JM64A	MCM68764	Motorola	\$14.95
JM64B	2764	Intel	\$14.95
JM64C	TMS2564	TI	\$14.95

## CONSUMER PRODUCTS

### SECURITY ALARM SYSTEMS

#### Home Alarm System

• Self-Installation • Presettable w/individual 3-digit code — no key rec. • Instant or 10-sec. delayed warning system • Alarm system incl. window & door contacts • One 9V battery required (not incl.) • Low power consumption (0.01mA) • Load audible alarm (800Hz) • Delayed exit feature • System complete w/one control station with built-in siren and test button, 4 magnetic contact sets & connecting wires for entire system

**ST-05 Home Alarm System** ..... \$59.95

#### Door Security System

• Coded door alarm • Instant or 7-second delay system • Alarm activated as door is opened • Can be deactivated by pressing personal code • Power: One 9V battery (not incl.) • System includes one personal code keypad and one magnetic sensor

**ES-07 Door Alarm** ..... \$29.95

#### Anti-Theft Auto Alarm System

• Audible horn is activated when door is trunk is opened • Alarm sounds for 3 min. — unless turned off by secret 3-digit code • Wire cutting will not deactivate alarm • Code set by owner • Uses only 0.01mA power • System complete w/one black-box control unit, one personal code keypad, 2 sets of sensors: one audible horn, & wiring (incl. one 10A fuse)

**CA-06 Auto Alarm** ..... \$59.95

### DIGITAL QUARTZ TIME PEN

• 5-Function: Hours, Minutes, Seconds, Month, Day • Liquid Crystal Display • 1/8" digits • Battery included • Uses standard Parker ink refills • Ultra-slim design (5/8" x 3/4")

**7717K Black/Gold Trim** ..... \$9.95 each

**7717SG Stainless Steel/Gold Trim** ..... \$9.95 each

**7717LR Red/Gold Trim** ..... \$9.95 each

## STICK-ON CLOCK

### 5-Function LCD Quartz Digital

• Hours • Minutes • Seconds • Month • Day • Flashing Clock • Ideal for car, kitchen, bathroom, office, etc. • 1/4" digits • Runs 2 years on 1 battery (incl.) • Size: 1-3/8" Round. Specify color: White/ST-001W, Black/ST-001B, Red/ST-001R. (Specify letter) ..... \$4.95 each or 2/\$8.95

### Stereo Cassette Player

with FM Stereo Tuner Pack

• Lightweight Headphones

• Cr20/Metal/Normal Tape Selector

• Anti-Rolling Mechanism

FEATURES: • Blue carrying case, shoulder strap, belt strap, lightweight headphones, FM stereo tuner pack & instruction manual • Talkback • Tone selector • Cr20/Metal/Normal tape selector • LED operation indicator • Built-in microphone • Stop/eject, play, rewind/review, fast forward/cue, tape/record selector functions • Vol. control • Ext. power input jack • Headphone jack • Auto-stop mechanism (shuts off player when tape ends) • Anti-rolling mechanism (prevents sound from quivering when walking, jogging, etc.) • Weight: 13 oz. • Requires 4 AA batteries (not included) • Size: 6-1/4" x 4-1/8" x 1-1/8"

**Model TWF-802** ..... \$69.95

**AM3-4 AA Alkaline Batteries** ..... 4/\$3.95



### Mini Stereo AM/FM Receiver

WITH HEADPHONES  
For Joggers, Cyclists,  
Skaters & Sports Events

FEATURES: Lightweight headphones. Left/right balance control. Full fidelity stereo sound. Additional black soft carrying case and shoulder strap. Belt clip (hands free). Operates on 3 AA cell batteries (not incl. — see below). Compact size: 3-1/8" H x 4-7/8" L x 1" D. Wt. 6 oz.

**Model 2830** ..... \$29.95

**AM3-3 AA Alkaline Batteries** ..... 3/\$2.95

## KEYBOARDS — POWER SUPPLIES

### MICRO SWITCH 68-KB KEYBOARD

Data Entry Keyboard. Encoded Output: 8-bit Parallel EBC DIC. Switching: Hall Effect, 24-pin Edge Card Connection. Complete w/PCB Connector. Can easily be modified to ASCII code.

Part No. KB69SD12-2 (Fits into DTE-20 Enclosure) ..... \$19.95 each

### MICRO SWITCH 85-KB KEYBOARD

Word Processing Keyboard, 26 Pin Edge Card Connection. Supply Voltage +5VDC. Main Keyboard is DWEITY. Additional Key Pads for Cursor and word processing functions.

Part No. 85SD18-1 ..... \$29.95 each

### MICRO SWITCH 88-KB KEYBOARD (PARALLEL)

Data Entry Keyboard used in a Diablo 1640 Terminal. Supply Voltage: +5V, -12V. Switching: Hall Effect — 10-pin Edge Card Connection. Schematic included. Uses 8048 Encoder Chip.

Part No. 88SD22 (Fits into DTE-20 Enclosure) ..... \$69.95 each

### POWER SUPPLY +5VDC @ 1 AMP REGULATED

Output: +5VDC @ 1A (also +30VDC). Input: 115VAC 60Hz, 2-tone black/beige self-enclosed case, 6 fl. 3 cond. black power cord, 6 1/2" W x 7" D x 2 1/4" H. Wt. 3 lbs. Data sheet incl.

Part No. PS51194 ..... \$19.95 each

### POWER SUPPLY +5VDC @ 1 AMP REGULATED

Output: +5VDC @ 1 amp (also +30VDC). Input: 115VAC 60Hz, 2-tone black/beige self-enclosed case, 6 fl. 3 cond. black power cord, 6 1/2" W x 7" D x 2 1/4" H. Wt. 3 lbs. Data sheet incl.

Part No. PS4070 ..... \$24.95 each

### POWER SUPPLY +5VDC @ 3 AMP REGULATED

Output: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp, 5VDC @ 2.5 amp. Adjustable current limit, Ripple & Noise: 1mV rms, 5mV p-p — 2 mounting surfaces. UL recognized. Size: 4" W x 4 1/2" L x 2 1/2" H — wt. 2 lbs. Data sheet included.

Part No. QPS-5 ..... \$29.95 each

### MULTI-VOLTAGE POWER SUPPLY

Output: 105-125VAC, 47-53Hz/205-250VAC, 47-53Hz. Output: +5VDC @ 2 amps Adj, 5VDC @ 50mA Fixed, +12VDC @ 1 amp Adj, -12V @ 2 amp Adj. Overvoltage protection. Size: 12 1/2" L x 4 1/2" W x 3 1/4" H — wt. 2 lbs. Data sheet included.

Part No. RA0250 ..... \$39.95 each

### POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Output: 115VAC, 50-60Hz @ 7.5 amp, 12VDC @ 1.5 amp. Fan volt./power supply select switch (115/230VAC). Output: 5VDC @ 7.5 amp, 12VDC @ 1.5 amp, 8 fl. blk. pow. cord, 11 1/2" W x 13 1/2" D x 3 1/4" H. Wt. 6 lbs.

Part No. PS94V0 ..... \$49.95 each

### POWER SUPPLY 4-Channel Switching Power Supply

Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC 47-440Hz. Output: +5VDC @ 5A, -5VDC @ 1A, +12VDC @ 1A, -12VDC @ 1A. Line ripple: <0.2%. Ripple: 30mV p-p. Load reg.: <1%. Overcurrent protection. Adj. 5V main output: 10%, 6-5/8" L x 1-7/8" W x 4-15/16" H. Wt. 1 1/2 lbs.

Part No. FDS-604A ..... \$69.95 each

### POWER SUPPLY Adjustable Switching 4-24VDC to 5 Amps

Adj. 4-24VDC 5VDC @ 4.8A, 5VDC @ 4.8A, 5VDC @ 3.3A, 18VDC @ 1.9A, 24VDC @ 1.9A. Overvoltage Protection. Input: 115VAC 50/60Hz. Output variations within 20mV, 8.25" L x 4.25" W x 2.25" H. Wt. 3.25 lbs.

**JE224 Kit** ..... \$79.95 each

**JE224A Assembled & Tested** ..... \$99.95 each

### SORENSEN Regulated Power Supplies

Sorensen's open construction (SOC) power supplies are series-regulated solid-state systems, designed to provide reg. DC voltages at 6 levels (2/28 vrange). These units are open-framed on sturdy black anodized aluminum for excellent mounting.

FEATURES: 115/208/230VAC Input @ 50-63Hz. Low Ripple: 1.5mVrms, 5mV p-p maximum. Adjustable current limit. Voltage adjustment control. All schematics and specifications supplied with unit. Series A,B,C,E have three mounting surfaces (Series F, bottom mounting only).

Part No.	Series	Adjustment Range	Output Current AMPs (Adj.)			Size (Inches)	Weight	Price
		min.	max.	040C	060C			
SOC 2-6	B	1.9, 2.1	6.0	4.9	3.8	5.62 x 4.8 x 2.50	4.3 lbs.	\$17.00
SOC 2-25	F	1.9, 2.1	25.0	21.5	17.5	16.00 x 4.88 x .888	16 lbs.	21.00
SOC 10-18	F	10.9, 12.9	18.0	15.0	12.0	14.00 x 4.88 x 1.7	12 lbs.	17.00
SOC 10-18	F	12.9, 14.9	20.0	17.5	15.0	16.00 x 4.88 x .888	16 lbs.	21.00
SOC 10-18	F	14.9, 16.9	22.0	19.5	16.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	16.9, 18.9	24.0	21.5	18.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	18.9, 20.9	26.0	23.5	20.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	20.9, 22.9	28.0	25.5	22.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	22.9, 24.9	30.0	27.5	24.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	24.9, 26.9	32.0	29.5	26.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	26.9, 28.9	34.0	31.5	28.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	28.9, 30.9	36.0	33.5	30.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	30.9, 32.9	38.0	35.5	32.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	32.9, 34.9	40.0	37.5	34.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	34.9, 36.9	42.0	39.5	36.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	36.9, 38.9	44.0	41.5	38.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	38.9, 40.9	46.0	43.5	40.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	40.9, 42.9	48.0	45.5	42.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	42.9, 44.9	50.0	47.5	44.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	44.9, 46.9	52.0	49.5	46.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	46.9, 48.9	54.0	51.5	48.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	48.9, 50.9	56.0	53.5	50.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	50.9, 52.9	58.0	55.5	52.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	52.9, 54.9	60.0	57.5	54.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	54.9, 56.9	62.0	59.5	56.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	56.9, 58.9	64.0	61.5	58.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	58.9, 60.9	66.0	63.5	60.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	60.9, 62.9	68.0	65.5	62.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	62.9, 64.9	70.0	67.5	64.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	64.9, 66.9	72.0	69.5	66.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	66.9, 68.9	74.0	71.5	68.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	68.9, 70.9	76.0	73.5	70.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	70.9, 72.9	78.0	75.5	72.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	72.9, 74.9	80.0	77.5	74.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	74.9, 76.9	82.0	79.5	76.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	76.9, 78.9	84.0	81.5	78.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	78.9, 80.9	86.0	83.5	80.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	80.9, 82.9	88.0	85.5	82.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	82.9, 84.9	90.0	87.5	84.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	84.9, 86.9	92.0	89.5	86.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	86.9, 88.9	94.0	91.5	88.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	88.9, 90.9	96.0	93.5	90.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	90.9, 92.9	98.0	95.5	92.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	92.9, 94.9	100.0	97.5	94.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	94.9, 96.9	102.0	99.5	96.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	96.9, 98.9	104.0	101.5	98.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	98.9, 100.9	106.0	103.5	100.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	100.9, 102.9	108.0	105.5	102.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	102.9, 104.9	110.0	107.5	104.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	104.9, 106.9	112.0	109.5	106.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	106.9, 108.9	114.0	111.5	108.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	108.9, 110.9	116.0	113.5	110.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	110.9, 112.9	118.0	115.5	112.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	112.9, 114.9	120.0	117.5	114.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	114.9, 116.9	122.0	119.5	116.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	116.9, 118.9	124.0	121.5	118.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	118.9, 120.9	126.0	123.5	120.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	120.9, 122.9	128.0	125.5	122.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	122.9, 124.9	130.0	127.5	124.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	124.9, 126.9	132.0	129.5	126.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	126.9, 128.9	134.0	131.5	128.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	128.9, 130.9	136.0	133.5	130.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	130.9, 132.9	138.0	135.5	132.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	132.9, 134.9	140.0	137.5	134.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	134.9, 136.9	142.0	139.5	136.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	136.9, 138.9	144.0	141.5	138.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	138.9, 140.9	146.0	143.5	140.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	140.9, 142.9	148.0	145.5	142.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	142.9, 144.9	150.0	147.5	144.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	144.9, 146.9	152.0	149.5	146.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	146.9, 148.9	154.0	151.5	148.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	148.9, 150.9	156.0	153.5	150.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	150.9, 152.9	158.0	155.5	152.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	152.9, 154.9	160.0	157.5	154.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	154.9, 156.9	162.0	159.5	156.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	156.9, 158.9	164.0	161.5	158.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	158.9, 160.9	166.0	163.5	160.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	160.9, 162.9	168.0	165.5	162.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	162.9, 164.9	170.0	167.5	164.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	164.9, 166.9	172.0	169.5	166.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	166.9, 168.9	174.0	171.5	168.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	168.9, 170.9	176.0	173.5	170.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	170.9, 172.9	178.0	175.5	172.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	172.9, 174.9	180.0	177.5	174.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	174.9, 176.9	182.0	179.5	176.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	176.9, 178.9	184.0	181.5	178.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	178.9, 180.9	186.0	183.5	180.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	180.9, 182.9	188.0	185.5	182.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	182.9, 184.9	190.0	187.5	184.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	184.9, 186.9	192.0	189.5	186.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	186.9, 188.9	194.0	191.5	188.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	188.9, 190.9	196.0	193.5	190.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	190.9, 192.9	198.0	195.5	192.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	192.9, 194.9	200.0	197.5	194.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	194.9, 196.9	202.0	199.5	196.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	196.9, 198.9	204.0	201.5	198.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	198.9, 200.9	206.0	203.5	200.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	200.9, 202.9	208.0	205.5	202.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	202.9, 204.9	210.0	207.5	204.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	204.9, 206.9	212.0	209.5	206.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	206.9, 208.9	214.0	211.5	208.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	208.9, 210.9	216.0	213.5	210.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	210.9, 212.9	218.0	215.5	212.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	212.9, 214.9	220.0	217.5	214.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	214.9, 216.9	222.0	219.5	216.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	216.9, 218.9	224.0	221.5	218.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	218.9, 220.9	226.0	223.5	220.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	220.9, 222.9	228.0	225.5	222.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	222.9, 224.9	230.0	227.5	224.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	224.9, 226.9	232.0	229.5	226.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	226.9, 228.9	234.0	231.5	228.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	228.9, 230.9	236.0	233.5	230.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	230.9, 232.9	238.0	235.5	232.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	232.9, 234.9	240.0	237.5	234.0	16.00 x 4.88 x 1.62	16 lbs.	21.00
SOC 10-18	F	234.9, 236.9	242.0	239.5	236.0	14.00 x 4.88 x 1.62	12 lbs.	17.00
SOC 10-18	F	236.9, 238.9	244.0	241.5	238.0	16.00 x 4.88 x 1.62		





**PPG**

# Electronic Kits make great Christmas gifts!

Available at stores nationwide.  
Call TOLL-FREE for the name of the store nearest you.  
SEND OR CALL FOR YOUR FREE 1983 HANDBOOK/CATALOG!

**SHOP EARLY!**

- 801 Pocket Dice
- 802 Signal Injector
- 803 Space War Gun
- 804 Metal Detector
- 805 Logic Probe
- 806 Burglar Alarm
- 808 Decision Maker
- 809 LED Pendulum Metronome
- 811 Double Decision Maker
- 812 Siren Oscillator
- 814 Robot Blinker
- 816 Mini-wink
- 818 Fish Caller
- 820 Shimmer Lights
- 821 Christmas Tree
- 822 One Channel Color Organ
- 824 Automatic Siren
- 826 Fuzz Box
- 828 9-Volt Power Supply
- 830 Multi-purpose Power Supply
- 834 Color Organ 3-channel, 1-control
- 836 3-channel, 4-control Color Organ
- 840 Variable Strobe Light
- 842 12-volt Color Organ
- 844 T.V. Jammer
- 846 12-volt Strobe Stick
- 850 Whooper Alarm
- 852 Combination Lock/Alarm Control
- 856 Electronic Tennis
- 858 Digital Roulette
- 860 5-24 Volt Regulated Power Supply
- 861 Big Sound Portable Organ
- 862 Full-wave Motor Speed Control
- 866 Digital Slot Machine
- 868 Digital Dice
- 870 Nerve Tester
- 876 6-digit Digital Clock
- 878 Digital Bird
- 880 12-volt, 2-amp Regulated Power Supply
- 882 Musical Horn
- 884 Sound Activated Color Organ, 1-channel
- 886 Audio Amp/intercom
- 888 Librarian Terminator
- 890 Stop-action Timing Tester
- 892 Telephone Hold Button
- 894 Phaser Gun/Sound Generator
- 898 Binary Clock

Call this toll-free number for your FREE, 32 page, 1983 Handbook/Catalog and for the name of the store nearest you.

Utah 1-801-628-3627  
**1-800-453-1708**  
PPG Electronics Co., Inc.  
791 Red Rock Road  
St. George, Utah 84770

64K DYNAMIC RAMS		Unit Price	Z80A		Unit Price
4164	150ns	7.50	Z80A CPU		5.50
4164	200ns	6.50	Z80A CTC		5.50
16K RAMS			Z80A PIO		5.50
4116	150ns	1.75	Z80A DART		15.00
4116	200ns	1.50	Z80A DMA		20.00
STATIC RAMS			Z80A SIO/0		20.00
2016P-1	100ns	7.00	Z80A SIO/1		20.00
2016P	150ns	6.00	Z80A SIO/2		20.00
6116P-3	150ns	6.50	8000		
6116LP-3	150ns	7.75	8035		5.50
2114LC-3	200ns	2.00	8039		6.00
2114LC-1	300ns	1.50	8080		6.00
EPROMS			8080-9		5.00
2716	450ns	3.75	8085		6.00
2716-1	350ns	6.00	8155		6.00
2732	450ns	5.75	8212		1.50
2732A-2	200ns	11.00	8216		1.50
2764K	250ns	15.00	8243		4.00
2764-4	450ns	13.00	8251A		4.00
2764-3	300ns	14.00	8255A-5		4.00
2532	450ns	6.50			
2564	450ns	13.00			

• MINIMUM ORDER : \$25.00

• VISA & MASTERCARD ACCEPTED

• PLEASE CALL FOR QUANTITY PRICING • PARTS 100% GUARANTEED \* PROMPT DELIVERY  
\* CALIFORNIA RESIDENTS ADD 6 1/2% SALES TAX/SHIPPING CHARGE \$3.00 UNDER 3 LBS.

**MONARCHY ENGINEERING, INC.**  
380 SWIFT AVENUE, UNIT 21 PO BOX 5517  
SO SAN FRANCISCO, CA 94080  
(415) 873-3055

**BAYONET Lamp SOCKETS**  
SNAP-IN SOCKET F.T.S. BAYONET BASE LAMPS (SEE B-2576, BELOW). SNAPS INTO A 5/8" HOLE, HAS 6" LONG WIRE LEADS. B-2575

15¢ 10/\$120 100/\$10.

**BAYONET 13V BULBS**  
#RH GE 1816 330 mA T-3V4 LIST PRICE IS 10/92.70

10/75¢ 3/4 LB 100/\$6.50

**2-1/4" 8Ω SPEAKER**  
MINIATURE UNIT, MFD BY QUAM IN USA, HAS 5/8" VOICE COIL IS IDEAL FOR BEEPING, SQUEALING OR VOICE PROJECT "I" DEEP

3 OZ 99¢

**VHF/UHF CHANNEL A-I MIDBAND Varactor TUNER**  
HI-GAIN, BRAND NEW, FOR UPGRADE OR CONVERTER USE. IF OUTPUT, USES +12V AND +24V SUPPLY. T-1195 WT 1/2 LB

\$11.95

**Brand New I15 VAC 8 Track TAPE DECK WITH PLAYBACK AMP**

3 LB X-6950 \$6.95

QUALITY BUILT BY MOTOROLA WITH AUTO TURN ON, END OF TAPE SENSOR, AUTO TRACK CHANGE, I15 VAC CAPACITOR START MOTOR, STEREO R/P HEAD AND +12VDC PLAY BACK ELECTRONICS. GREAT FOR HOME BREW PHONE ANSWERS, ROBOTS, ETC.

OUTSIDE USA SEND \$1 FOR CATALOG

**DIP SOCKETS**

8 PIN 16¢ S-0800  
14 PIN 18¢ S-1400  
16 PIN 20¢ S-1600  
18 PIN 25¢ S-1800  
24 PIN 38¢ S-2400  
28 PIN 45¢ S-2800  
40 PIN 55¢ S-4000

**BCD Thumbwheel SWITCH**  
WITH COMPLIMENT 0-9

B-2124 GOLD CONTACTS STD. SIZE CAN BE STACKED TO ANY WIDTH OUTPUT IS 1-2, 4-8 WITH COMPLIMENT

\$1.25

**B-1181 2 OZ CARLING Heavy Duty Momentary 10 Amp ROCKER**  
SNAPS INTO 3/4" X 1-3/8" CUTOFF. SPECIFY YOUR CHOICE OF RED, WHITE OR BLACK ROCKER

\$1.50

**3 AG FUSES**

F-0102 WT 1 OZ 35 A 32 V MFD BY LITTLEFUSE  
F-0101 WT 1 OZ 1-1/2 A 250 V MFD BY BUSS

ANY QUANTITY 10¢ EACH YOUR CHOICE

**28/56 EDGE Connector**  
\* GOLD \* BIFURCATED CONTACTS \* C-0356 10/\$9. 1 LB 6 LB 100/\$80. 1000/\$750. 60 LB

**6 VOLT 5 AMP-HR RECHARGEABLE SEALED BATTERY**  
LEAD ACID SIZE: 5-3/8" X 3-1/8" X 1-7/8"

\$9.50

**MARINE TOGGLE SWITCH**  
HEAVY DUTY SPST CAST ALUMINUM CASE

\$1.50

**PILOT LIGHTS**  
14V OPERATION SNAP-IN DESIGN LOOKS GREAT IN CAR OR BOAT

3 OZ FITS 1/2 X 1" HOLE

**.068 mfd 250 V Molded CAP**  
C-1015 4 X 3 X 1" 25/\$1 WT 2 OZ 4 OZ 250/\$8 1000/\$30 1/2 LB

**5 x 7 x 12" INSTRUMENT CASE**  
LOCAL MFR NEEDS LEADER SCOPES BUT DOESN'T NEED THE CASES! SO, HE SELLS 'EM TO US! THE FRONT PANELS ARE PUNCHED, BUT REPLACES WITH 2 SCREWS. BACK HAS BANANNA JACKS AND CORD WINDER. TWO TONE BLUE COLOR. GREAT FOR HOMEBREW PROJECTS

\$9.95

**PC TRANSFORMER**  
DUAL 13V 350 mA

\$1.50

**SIGNAL MATS**  
TAPESWITCH MODEL CVP 623 IS UL APPROVED MEASURES 6" X 23" OUTPUT IS 2 PIN MOLEX

\$7.95

**ETCHANT**  
AMMONIUM PERSULFATE FAST & EASY TO USE, MIX 1/2 POUND TO A GALLON OF WATER. 1 OZ TO 1 PINT AND ETCH! THE WHITE CRYSTALS MAKE A CLEAR SOLUTION THAT TURNS BLUE WHEN FULL OF COPPER.

\$1.95

**DIAMONDBACK ELECTRONICS COMPANY**  
PO BOX 12095 SARASOTA, FL 33578

Phone Orders 813-953-2829



# Lowest Prices Video and Electronic Components

## COAXIAL A/B SWITCHES

Select from two inputs to VCR or TV

- A-CS75/75 75 ohm inputs/75 ohm output \$2.75 ea. 10/\$22.00
- A-CS75/75P Professional version of above \$7.50 ea. 10/\$60.00
- A-CS75/300 75 ohm inputs/300 ohm output \$2.75 ea. 10/\$22.00

## REPLACEMENT TV GAME/COMPUTER SWITCH

A-STVC STD RCA INPUT/300 ohm output \$2.50 ea. 10/\$20.00

## UHF/VHF/FM MATCHING TRANSFORMERS

Converts 75 ohm to 300 ohm inputs

- A-MT75-300 Indoor universal 69c ea. 10/\$5.50
- A-MT75-300B Outdoor with boot 99c ea. 10/\$8.00

## UHF/VHF/FM

HYBRID SIGNAL SPLITTERS  
Splits one input to multiple outputs

- A-CMS2-M2 2-way splitter (75 ohm) \$1.65 ea. 10/\$13.00
- A-CMS3 3-way splitter (75 ohm) \$2.25 ea. 10/\$18.00
- A-ACP4 4-way splitter (300 ohm) \$2.25 ea. 10/\$18.00

## UNIVERSAL REPLACEMENT ANTENNAS

- A-AR6 SONY Trinitron type antenna \$7.99 ea. 10/\$64.
- A-ABS-U Back-of-set VHF/FM antenna \$4.25 ea. 10/\$34.00

## POPULAR VIDEO CONNECTORS/ADAPTORS

- A-F81C F to F female splice 50c ea. 10/\$4.00
- A-VA9 F jack to RCA plug adaptor \$1.49 ea. 10/\$12.00
- A-VA10 RCA jack to F plug adaptor \$1.49 ea. 10/\$12.00
- A-VA5 RCA jack to BNC plug adaptor \$1.69 ea. 10/\$13.50
- A-VA2 Double female BNC adaptor \$1.99 ea. 10/\$16.00
- A-VA14 Quick connect F plug adaptor 89c ea. 10/\$7.00

## POPULAR VIDEO HOOK-UP/DUBBING COAXIAL CABLES

(Molded heavy-duty construction)

- A-VC106 RCA plug to mini plug (6 ft.) \$2.75 ea. 10/\$22.00
- A-VC306 RCA plug to RCA plug (6 ft.) \$2.75 ea. 10/\$22.00
- A-VC406 Quick F plug to quick F plug (6 ft.) \$2.99 ea. 10/\$24.00
- A-VC612 BNC plug to BNC plug (12 ft.) \$5.99 ea. 10/\$48.00

## VHF/FM SIGNAL BOOSTERS/ DISTRIBUTION AMPLIFIERS (75 ohm)

- A-CMA1 One output booster (10dB Gain) \$9.50 ea. 10/\$76.00
- A-CMA4 Four output booster (3dB Gain) \$11.95 ea. 10/\$95.00

**SUPER  
SPECIAL!**

## EXPERIMENTER/TECHNICIAN ELECTRONIC COMPONENT KITS

Each kit in reusable compartmentalized storage cabinet

- SK-CD 5PI to .1MF (150 pcs)
- SK-RM25 10 ohms to 10 meg (350 pcs)
- SK-RM50 10 ohms to 10 meg (350 pcs)

**ONLY \$9.95 ea.**

**Plus FREE BONUS**

30 watt soldering iron with each kit ordered (\$49.99 value)

**BONUS!**

## RECEIVE A FREE GIFT WITH EVERY ORDER \$50 OR OVER

- \$50 order receive free auto fm signal booster (\$12.50 value)
- \$100 order receive free ultra light stereo headphones (\$25 value)
- \$200 order receive free am/fm stereo walkman type radio with headphones (\$50 value)

LIKE SAVING AN ADDITIONAL 25%

# STEVEN PRODUCTS

P.O. Box 698, Melville, N.Y. 11747

To order call collect

(516) 752-0060

- \* VISA \* MASTER CHARGE
- \* CHECK \* MONEY ORDER
- N.Y. STATE RESIDENTS
- ADD APPROPRIATE SALES TAX

Add for Shipping & Insurance  
\$250.00 to \$500.00 \$ 4.50  
\$501.00 to \$750.00 6.00  
\$751.00 to \$1000.00 12.00  
Over \$1000.00 12.50  
C.O.D. extra

## CPU'S & SUPPORT CHIPS

8080A	2.75	8251	5.75
8086A	6.75	8255	6.95
AMD 2901	8.95	8259	6.95
8202	19.95	8267 (AM9517)	7.95
8212	2.25	8300	15.00
8214	3.60	8302	6.00
8216	2.90	290A CPU	3.75
8224	3.25	290A S10	12.95
MM5307	9.95	290A P10	3.75
8226	2.75	290 CTTA	3.75
8228	4.50	TMS 9227 NL	9.95
8185	9.00	8275	16.95
8237	14.00	8965	13.95
3242	6.00	8970	2.50

## RAM's

21L02.3	70	2708	2.95
92L42	5.95	2716 + 5V	4.25
2101-1	1.95	2722	8.95
2111AL	1.95	2832	7.95
2114L.3	1.95	2764.25	18.95
2147.3	4.95	82523	1.95

## ROM's

2101-1	1.95	2832	7.95
2111AL	1.95	2832	7.95
2114L.3	1.95	2764.25	18.95
2147.3	4.95	82523	1.95

## INTERFACE & DRIVERS

1488	.90	MM1402	1.75
1489	.90	MM1403	1.75
8130	2.50	MM1404	1.75
8830	2.50	MM5013	2.50
8131	2.50	MM5056	2.50
8833	2.50	MM5056	2.50
8834	2.00	MM5057	2.50
8837	2.00	MM5058	2.50
MM521	9.50	MM5090	2.50
MM5369	2.50		

## SHIFT REGISTER

1488	.90	MM1402	1.75
1489	.90	MM1403	1.75
8130	2.50	MM1404	1.75
8830	2.50	MM5013	2.50
8131	2.50	MM5056	2.50
8833	2.50	MM5056	2.50
8834	2.00	MM5057	2.50
8837	2.00	MM5058	2.50
MM521	9.50	MM5090	2.50
MM5369	2.50		

## UART's

TR1602B	9.95	AM9588A	8.95
PT142B	3.25	CMX307	3.75

## 14 PIN HEADERS

14 PIN HEADERS	\$3.00
24 PIN HEADERS	.75
40 PIN HEADERS	1.10
50 PIN EDGEBOARD CONN.	3.95
26 PIN EDGEBOARD CONN.	2.50
50 PIN RIGHT ANGLE CONN.	3.95
20 PIN RIGHT ANGLE CONN.	2.25

## 50 PIN RIBBON CONNECTORS

50 PIN RIBBON CABLE CONN.	\$3.25
50 PIN RIBBON CABLE CONN.	\$3.25
50 PIN RIBBON CABLE CONN.	\$3.25
50 PIN RIBBON CABLE CONN.	\$3.25

## 4" x 6" DOUBLE SIDED EPOXY BOARD 1/4" THICK

4" x 6" DOUBLE SIDED EPOXY BOARD 1/4" THICK	\$5.00
4" x 6" DOUBLE SIDED EPOXY BOARD 1/4" THICK	\$5.00

## EPOXY GLASS VECTOR BOARD

1/16" thick with 110" spacing  
4 1/2" x 6 1/2" ..... \$1.95

## CRYSTALS - 2.95 ea.

1.000	4.000	6.144	18.000
2.000	5.000	8.000	18.432
3.000	6.000	10.000	20.000
3.579			

## 7 WATT LD 65 LASER

DIODE(R) \$8.95

25 watt Infra Red Pulse (SG 2006 equiv.)  
Laser Diode (Spec sheet included) \$24.95

## 2N3820 P FET

2N3820 P FET	\$ .45
2N5457 N FET	\$ .45
2N2646 J.U.T.	\$ .45
ER 900 TRIGGER DIODES	\$4.91
2N 6028 PROG. UJT	\$ .65

## DISC CAPACITORS

10UF 16V	10/81.00	100/88.00
10UF 35V	16/81.00	100/95.00

## IN4148 (IN914) 15/1.00

## TANTALUM CAPACITORS

22UF 35V 5/81.00	10UF 20V	\$ .40
47UF 35V 5/81.00	22UF 10V	\$ .30
68UF 35V 5/81.00	15UF 16V	3/81.00
10UF 20V 5/81.00	30UF 6V	5/81.00
2.2UF 20V 5/81.00	33UF 10V	\$ .40
3.3UF 20V 4/81.00	47UF 20V	\$ .85
4.7UF 35V 4/81.00	68UF 10V	\$1.00
6.8UF 35V 3/81.00	120UF 6V	\$ .75
	200UF 20V	\$1.75

## DIP SOCKETS

8 PIN	.17	20 PIN	.30
14 PIN	.20	24 PIN	.35
16 PIN	.22	28 PIN	.40
18 PIN	.25	40 PIN	.60

## RS232 CONNECTORS

DB 25P male	\$2.75
DB 25S female	3.75
HOODS	1.25

## POSTAGE RATES

ADD 10% FOR ORDERS UNDER \$25.00  
ADD 5% FOR ORDERS BETWEEN \$25.00 AND \$50.00  
ADD 3% FOR ORDERS ABOVE \$50.00

## C/MOS

4001	25	4028	55	4081	20	74C32	45
4002	25	4029	75	4082	20	74C42	1.00
4006	85	4030	85	4093	85	74C73	.75
4007	27	4034	1.75	4099	1.75	74C74	.50
4009	45	4040	65	4510	85	74C76	.70
4010	45	4042	55	4511	85	74C86	.50
4011	22	4043	65	4514	85	74C93	1.40
4012	22	4044	65	4515	150	74C93	.95
4013	30	4046	85	4516	85	74C95	.50
4014	70	4047	1.25	4518	1.25	74C157	1.75
4015	30	4050	40	4520	70	74C180	1.20
4016	60	4051	80	4523	1.25	74C181	1.15
4017	30	4052	80	4524	1.25	74C183	1.15
4018	45	4053	75	4525	85	74C174	1.30
4019	45	4054	75	4526	85	74C175	1.30
4020	45	4055	75	4527	85	74C176	1.30
4021	45	4056	75	4528	85	74C177	1.30
4022	45	4057	75	4529	85	74C178	1.30
4023	45	4058	75	4530	85	74C179	1.30
4024	45	4059	75	4531	85	74C180	1.30
4025	45	4060	75	4532	85	74C181	1.30
4026	45	4061	75	4533	85	74C182	1.30
4027	45	4062	75	4534	85	74C183	1.30

## DOUBLE SIDED DIP RIBBON CABLE JUMPER ASSEMBLIES

16 PIN 4" LONG	\$ 2.50
14 PIN 12" LONG	\$ 2.50

## RS 232 CABLE

10 Conductor, #22 color coded wire, gray PVC outer cover, 3/8" diameter

40 per ft. - 100/330.00

Add 20% postage for orders under 100'

Add 10% postage for orders over 100'

## SPECIALS

CPU's	CRT Controllers
-------	-----------------

6502	\$6.00	TMS9927NL	\$ 9.95
8080A	2.75	6845	13.95
Z80A	3.75	8275	16.95

## RAM's

2114L.4	\$1.35
4116-2	1.60
MM4802-3-2KX8	8.95
93L422 32P-KX8	5.95
2147-2-64K	7.95
4147 J3	4.95
4118-4	6.95

## DISC Controllers

1791	25.00
1793	35.00
1795	45.00
1797	45.00
D765C	25.00

## 68000L3 \$70.00

## SPECIALS GOOD THRU DEC. 1982

## NO. 30 WIRE

WRAP WIRE SINGLE STRAND 100' \$1.40

## TOGGLE SWITCHES

1060	SPDT	1.10
2060	DPDT	1.20
2069	DPDT	CENTER OFF \$1.75

## SCR's

15A	6A	35A	110A
100	.45	.60	1.40
200	.70	.80	1.90
400	1.20	1.40	2.60
600	1.80	3.60	15.00

## TRIAC's

PRV	1A	10A	25A
100	.45	.80	1.55
200	.84	1.30	2.10
400	1.30	1.90	3.10
600	2.00	2.75	4.30

## 20KV 250MA DIODE \$1.90

## SILICON POWER RECTIFIERS

PRV	1A	3A	12A	50A	125A	240A
-----	----	----	-----	-----	------	------

WRAP WIRE	CTS 206-4	4 POSITION 1
SINGLE STRAND	CTS 206-7	7 POSITION 1



# 4164 64K DYNAMIC \$625

200 NS

ALL MERCHANDISE 100% GUARANTEED!

# TMM2016 2KX8 STATIC \$415

200 NS

CALL US FOR VOLUME QUOTES

## STATIC RAMS

2101	256 x 4 (450ns)	1.95
5101	256 x 4 (450ns) (cmos)	3.95
2102-1	1024 x 1 (450ns)	.89
2102L-4	1024 x 1 (450ns) (LP)	1.29
2102L-2	1024 x 1 (250ns) (LP)	1.69
2111	256 x 4 (450ns)	2.99
2112	256 x 4 (450ns)	2.99
2114	1024 x 4 (450ns)	8/14.95
2114L-4	1024 x 4 (450ns) (LP)	8/15.25
2114L-3	1024 x 4 (300ns) (LP)	8/15.45
2114L-2	1024 x 4 (200ns) (LP)	8/15.95
2147	4096 x 1 (55ns)	4.95
TMS4044-4	4096 x 1 (450ns)	3.49
TMS4044-3	4096 x 1 (300ns)	3.99
TMS4044-2	4096 x 1 (200ns)	4.49
MK4118	1024 x 8 (250ns)	9.95
TMM2016-200	2048 x 8 (200ns)	4.15
TMM2016-150	2048 x 8 (150ns)	4.95
TMM2016-100	2048 x 8 (100ns)	6.15
HM6116-4	2048 x 8 (200ns) (cmos)	4.95
HM6116-3	2048 x 8 (150ns) (cmos)	5.95
HM6116-2	2048 x 8 (120ns) (cmos)	8.95
HM6116LP-4	2048 x 8 (200ns) (cmos)(LP)	6.95
HM6116LP-3	2048 x 8 (150ns) (cmos)(LP)	8.95
HM6116LP-2	2048 x 8 (120ns) (cmos)(LP)	10.95
Z-6132	4096 x 8 (300ns) (Qstat)	34.95

LP = Low Power Qstat = Quasi-Static

## DYNAMIC RAMS

TMS4027	4096 x 1 (250ns)	1.99
MK4108	8192 x 1 (200ns)	1.95
MM5298	8192 x 1 (250ns)	1.85
4116-300	16384 x 1 (300ns)	8/11.75
4116-250	16384 x 1 (250ns)	8/11.95
4116-200	16384 x 1 (200ns)	8/13.95
4116-150	16384 x 1 (150ns)	8/15.95
4116-120	16384 x 1 (120ns)	8/29.95
2118	16384 x 1 (150ns) (5v)	4.95
MK4816	2048 x 8 (300ns) (5v)	24.95
4164-200	65536 x 1 (200ns) (5v)	6.25
4164-150	65536 x 1 (150ns) (5v)	7.25

5V = single 5 volt supply

## EPROMS

1702	256 x 8 (1us)	4.50
2708	1024 x 8 (450ns)	3.95
2758	1024 x 8 (450ns) (5v)	5.95
2716	2048 x 8 (450ns) (5v)	3.95
2716-1	2048 x 8 (350ns) (5v)	6.25
TMS2716	2048 x 8 (450ns)	7.95
TMS2532	4096 x 8 (450ns) (5v)	7.95
2732	4096 x 8 (450ns) (5v)	4.95
2732-250	4096 x 8 (250ns) (5v)	12.95
2732-200	4096 x 8 (200ns) (5v)	16.95
2764	8192 x 8 (450ns) (5v)	16.95
2764-250	8192 x 8 (250ns) (5v)	18.95
2764-200	8192 x 8 (200ns) (5v)	19.95
TMS2564	8192 x 8 (450ns) (5v)	24.95
MC68764	8192 x 8 (450ns) (5v)(24 pin)	call

5v = Single 5 Volt Supply

## EPROM ERASERS

	Timer	Capacity Chip	Intensity (uW/Cm <sup>2</sup> )	
PE-14		6	5,200	83.00
PE-14T	X	6	5,200	119.00
PE-24T	X	9	6,700	175.00
PL-265T	X	20	6,700	255.00
PR-125T	X	16	15,000	349.00
PR-320	X	32	15,000	595.00

## DISC CONTROLLERS

1771	16.95
1791	29.95
1793	38.95
1795	54.95
1797	54.95
6843	34.95
8272	39.95
UPD765	39.95
1691	18.95
2143	18.95

## INTERFACE

8T26	1.69
8T28	2.49
8T95	.99
8T96	.99
8T97	.99
8T98	.99
DM8131	2.95
DP8304	2.29
DS8835	1.99
DS8836	.99

## MISC.

3242	7.95
3341	4.95
MC3470	4.95
MC3480	9.00
11C90	13.95
95H90	7.95
2513-001 UP	9.95
2513-002 LOW	9.95

## SOUND CHIPS

76477	3.95
76489	8.95
AY3-8910	12.95
MC3340	1.49

## CRT CONTROLLERS

6845	14.95
68B45	35.95
HD46505SP	15.95
6847	12.25
68047	24.95
8275	29.95
7220	99.95
CRT5027	39.95
CRT5037	49.95
TMS9918A	39.95

## BIT-RATE GENERATORS

MC14411	11.95
BR1941	11.95
4702	12.95
COM5016	16.95
COM8116	10.95
MM5307	10.95

## UARTS

AY3-1014	6.95
AY5-1013	3.95
PT1472	9.95
TR1602	3.95
2350	9.95
2651	8.95
TMS6011	5.95
IM6402	7.95
IM6403	8.95
INS8250	14.95

## KEYBOARD CHIPS

AY5-2376	11.95
AY5-3600	11.95
74C922 See 74C00	
74C923 Series Prices	

## CLOCK CIRCUITS

MM5314	4.95
MM5369	3.95
MM5375	4.95
MM58167	8.95
MM58174	11.95
MSM5832	6.95

## Z-80 2.5 Mhz

Z80-CPU	3.95
Z80-CTC	5.95
Z80-DART	15.25
Z80-DMA	17.50
Z80-PIO	5.75
Z80-SIO/0	18.50
Z80-SIO/1	18.50
Z80-SIO/2	18.50
Z80-SIO/9	16.95

## 4.0 Mhz

Z80A-CPU	6.00
Z80A-CTC	8.65
Z80A-DART	18.75
Z80A-DMA	27.50
Z80A-PIO	6.00
Z80A-SIO/0	22.50
Z80A-SIO/1	22.50
Z80A-SIO/2	22.50
Z80A-SIO/9	19.95

## 6.0 Mhz

Z80B-CPU	17.95
Z80B-CTC	15.50
Z80B-PIO	15.50

## ZILOG

Z6132	34.95
Z8671	39.95

## CRYSTALS

32.768 khz	1.95
1.0 mhz	4.95
1.8432	4.95
2.0	3.95
2.097152	3.95
2.4576	3.95
3.2768	3.95
3.579535	3.95
4.0	3.95
5.0	3.95
5.0688	3.95
5.185	3.95
5.7143	3.95
6.0	3.95
6.144	3.95
6.5536	3.95
8.0	3.95
10.7836	3.95
14.31818	3.95
15.0	3.95
16.0	3.95
18.0	3.95
18.432	3.95
20.0	3.95
22.1184	3.95
32.0	3.95

## DATA ACQUISITION

ADC0800	15.55
ADC0804	3.49
ADC0809	4.49
ADC0817	9.95
DAC0800	4.95
DAC0806	1.95
DAC0808	2.95
DAC1020	8.25
DAC1022	5.95
MC1408L6	1.95
MC1408L8	2.95

## 8000

8035	5.95
8039	6.95
INS-8060	17.95
INS-8073	24.95
8080	3.95
8085	5.95
8085A-2	11.95
8086	29.95
8087	CALL
8088	39.95
8089	89.95
8155	7.95
8156	8.95
8185	29.95
8185-2	39.95
8741	39.95
8748	29.95
8755	32.00

## 6800

68000	99.95
6800	4.95
6802	7.95
6808	13.90
6809E	19.95
6809	12.95
6810	2.95
6820	4.95
6821	3.25
6828	14.95
6840	12.95
6843	34.95
6844	25.95
6845	14.95
6847	12.25
6850	3.45
6852	5.75
6860	9.95
6862	11.95
6875	6.95
6880	2.25
6883	24.95
68047	24.95
68488	19.95

## 6800 1MHZ

68B00	10.95
68B02	22.25
68B09E	29.95
68B09	29.95
68B10	7.95
68B21	12.95
68B45	35.95
68B50	12.95

## 68B00 2 MHZ

## 6500

6502	1 MHZ	5.95
6504		6.95
6505		8.95
6507		9.95
6520		4.35
6522		8.75
6532		11.25
6545		22.50
6551		11.85

## 2 MHZ

6502A	9.95
6522A	11.70
6532A	12.40
6545A	28.50
6551A	12.95

## 3 MHZ

6502B	14.95
-------	-------

## FUNCTION GENERATORS

MC4024	3.95
LM566	1.49
XR2206	3.75
8038	3.95

## EXAR

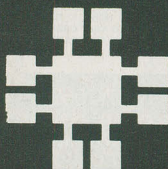
XR 2206	3.75
XR 2207	3.85
XR 2208	3.90
XR 2211	5.25
XR 2240	3.25

## INTERSIL

ICL7103	9.50
ICL7106	9.95
ICL7107	12.95
ICL8038	3.95
ICM7207A	5.59
ICM7208	15.95

## 9000 SERIES

9316	1.00
9334	2.50
9368	3.95
9401	9.95
9601	.75
9602	1.50
96S02	1.95



# JDR MICRODEVICES, INC.

1224 S. Bascom Avenue  
San Jose, CA 95128

800-538-5000 • 800-662-6279 (CA)  
(408) 995-5430 • Telex 171-110

© 1982 JDR MICRODEVICES, INC.

VISIT OUR  
RETAIL STORE

— NEW HOURS —  
M-W-F, 9-5  
T-Th., 9-9 Sat. 11-3

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: For shipping include \$2 for UPS Ground or \$3 for UPS Blue Label Air. Items over 5 pounds require additional shipping charges. Foreign orders, include sufficient amount for shipping. There is a \$10 minimum order. Bay Area and Los Angeles Counties add 6% Sales Tax. Other California residents add 6% Sales Tax. We reserve the right to substitute manufacturer. Not responsible for typographical errors. Prices are subject to change without notice. We will match or beat any competitor's price provided it is not below our cost.



## 74LS00

74LS00	.24	74LS86	.39	74LS169	1.75	74LS323	2.75
74LS01	.25	74LS90	.55	74LS170	1.49	74LS324	1.75
74LS02	.25	74LS91	.89	74LS173	.69	74LS352	1.29
74LS03	.25	74LS92	.55	74LS174	.55	74LS353	1.29
74LS04	.24	74LS93	.55	74LS175	.55	74LS363	1.35
74LS05	.25	74LS95	.75	74LS181	2.15	74LS364	1.95
74LS08	.28	74LS96	.89	74LS189	8.95	74LS365	.49
74LS09	.29	74LS107	.39	74LS190	.89	74LS366	.49
74LS10	.25	74LS109	.39	74LS191	.89	74LS367	.45
74LS11	.35	74LS112	.39	74LS192	.79	74LS368	.45
74LS12	.35	74LS113	.39	74LS193	.79	74LS373	.99
74LS13	.45	74LS114	.39	74LS194	.69	74LS374	.99
74LS14	.59	74LS122	.45	74LS195	.69	74LS377	1.39
74LS15	.35	74LS123	.75	74LS196	.79	74LS378	1.18
74LS20	.25	74LS124	2.90	74LS197	.79	74LS379	1.35
74LS21	.29	74LS125	.49	74LS221	.89	74LS385	1.90
74LS22	.25	74LS126	.49	74LS240	.95	74LS386	.45
74LS26	.29	74LS132	.59	74LS241	.99	74LS390	1.19
74LS27	.29	74LS133	.59	74LS242	.99	74LS393	1.19
74LS28	.35	74LS136	.39	74LS243	.99	74LS395	1.19
74LS30	.25	74LS137	.99	74LS244	.99	74LS399	1.49
74LS32	.29	74LS138	.55	74LS245	1.49	74LS424	2.95
74LS33	.55	74LS139	.55	74LS247	.75	74LS447	.37
74LS37	.35	74LS145	1.20	74LS248	.99	74LS490	1.95
74LS38	.35	74LS147	2.49	74LS249	.99	74LS624	3.99
74LS40	.25	74LS148	1.35	74LS251	.59	74LS668	1.69
74LS42	.49	74LS151	.55	74LS253	.59	74LS669	1.89
74LS47	.75	74LS153	.55	74LS257	.59	74LS670	1.49
74LS48	.75	74LS154	1.90	74LS258	.59	74LS674	9.65
74LS49	.75	74LS155	.69	74LS259	2.75	74LS682	3.20
74LS51	.25	74LS156	.69	74LS260	.59	74LS683	3.20
74LS54	.29	74LS157	.65	74LS266	.55	74LS684	3.20
74LS55	.29	74LS158	.59	74LS273	1.49	74LS685	3.20
74LS63	1.25	74LS160	.69	74LS275	3.35	74LS688	2.40
74LS73	.39	74LS161	.65	74LS279	.49	74LS689	3.20
74LS74	.35	74LS162	.69	74LS280	1.98	74LS783	24.95
74LS75	.39	74LS163	.65	74LS283	.69	81LS95	1.49
74LS76	.39	74LS164	.69	74LS290	.89	81LS96	1.49
74LS78	.49	74LS165	.95	74LS293	.89	81LS97	1.49
74LS83	.60	74LS166	1.95	74LS295	.99	81LS98	1.49
74LS85	.69	74LS168	1.75	74LS298	.89	25LS2521	2.80
						25LS2569	4.25

## IC SOCKETS

8 pin ST	1.99	100
14 pin ST	.13	.11
16 pin ST	.15	.12
18 pin ST	.17	.13
20 pin ST	.20	.18
22 pin ST	.29	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39
ST SOLDERTAIL		
8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80
WW WIREWRAP		
16 pin ZIF	6.75	call
24 pin ZIF	9.95	call
ZIF TEXTTOOL (Zero Insertion Force)		

## CONNECTORS

RS232 MALE	2.95
RS232 FEMALE	3.50
RS232 FEMALE	3.50
RIGHT ANGLE	5.25
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95

## DIP SWITCHES

4 POSITION	.85
5 POSITION	.90
6 POSITION	.90
7 POSITION	.95
8 POSITION	.95

## 7400

7400	.19	74132	.45
7401	.19	74136	.50
7402	.19	74141	.65
7403	.19	74142	2.95
7404	.19	74143	2.95
7405	.25	74145	.60
7406	.29	74147	1.75
7407	.29	74148	1.20
7408	.24	74150	1.35
7409	.19	74151	.55
7410	.19	74152	.65
7411	.25	74153	.55
7412	.30	74154	1.25
7413	.35	74155	.75
7414	.49	74156	.65
7416	.25	74157	.55
7417	.25	74159	1.65
7420	.19	74160	.85
7421	.35	74161	.69
7422	.35	74162	.85
7423	.29	74163	.69
7425	.29	74164	.85
7426	.29	74165	.85
7427	.29	74166	1.00
7428	.45	74167	2.95
7430	.19	74170	1.65
7432	.29	74172	5.95
7433	.45	74173	.75
7437	.29	74174	.89
7438	.29	74175	.89
7440	.19	74176	.89
7442	.49	74177	.75
7443	.65	74178	1.15
7444	.69	74179	1.75
7445	.69	74180	.75
7446	.69	74181	2.25
7447	.69	74182	.75
7448	.69	74184	2.00
7450	.19	74185	2.00
7451	.23	74186	18.50
7453	.23	74190	1.15
7454	.23	74191	1.15
7460	.23	74192	.79
7470	.35	74193	.79
7472	.29	74194	.85
7473	.34	74195	.85
7474	.33	74196	.79
7475	.45	74197	.75
7476	.35	74198	1.35
7480	.59	74199	1.35
7481	1.10	74221	1.35
7482	.95	74246	1.35
7483	.50	74247	1.25
7485	.59	74248	1.85
7486	.35	74249	1.95
7489	2.15	74251	.75
7490	.35	74259	2.25
7491	.40	74265	1.35
7492	.50	74273	1.95
7493	.35	74276	1.25
7494	.65	74279	.75
7495	.55	74283	2.00
7496	.70	74284	3.75
7497	2.75	74285	3.75
74100	1.75	74290	.95
74107	.30	74293	.75
74109	.45	74298	.85
74110	.45	74351	2.25
74111	.55	74365	.65
74116	1.55	74366	.65
74120	1.20	74367	.65
74121	.29	74368	.65
74122	.49	74376	2.20
74123	.49	74390	1.75
74125	.45	74393	1.35
74126	.45	74425	3.15
74128	.55	74426	.85
		74490	2.55

## CMOS

4000	.29	4528	1.19
4001	.25	4531	.95
4002	.25	4532	1.95
4006	.89	4538	1.95
4007	.29	4539	1.95
4008	.95	4543	1.19
4009	.39	4555	.95
4010	.45	4556	.95
4011	.25	4581	1.95
4012	.25	4582	1.95
4013	.38	4584	.75
4014	.79	4585	.75
4015	.39	4702	12.95
4016	.39	74C00	.35
4017	.69	74C02	.35
4018	.79	74C04	.35
4019	.39	74C08	.35
4020	.75	74C10	.35
4021	.79	74C14	.59
4022	.79	74C20	.35
4023	.29	74C30	.35
4024	.65	74C32	.39
4025	.29	74C42	1.29
4026	1.65	74C48	1.99
4027	.45	74C73	.65
4028	.69	74C74	.65
4029	.79	74C76	.80
4030	.39	74C83	1.95
4034	1.95	74C85	1.95
4035	.85	74C86	.39
4040	.75	74C89	4.50
4041	.75	74C90	1.19
4042	.69	74C93	1.75
4043	.85	74C95	.99
4044	.79	74C107	.89
4046	.85	74C150	5.75
4047	.95	74C151	2.25
4049	.35	74C154	3.25
4050	.35	74C157	1.75
4051	.79	74C160	1.19
4053	.79	74C161	1.19
4060	.89	74C162	1.19
4066	.39	74C163	1.19
4068	.39	74C164	1.39
4069	.29	74C165	2.00
4070	.35	74C173	.79
4071	.29	74C174	1.19
4072	.29	74C175	1.19
4073	.29	74C192	1.49
4075	.29	74C193	1.49
4076	.79	74C195	1.39
4078	.29	74C200	5.75
4081	.29	74C221	1.75
4082	.29	74C373	2.45
4085	.95	74C374	2.45
4086	.95	74C901	.39
4093	.49	74C902	.85
4098	2.49	74C903	.85
4099	1.95	74C905	10.95
14409	12.95	74C906	.95
14410	12.95	74C907	1.00
14411	11.95	74C908	2.00
14412	12.95	74C909	2.75
14419	7.95	74C910	9.95
4502	.95	74C911	8.95
4503	.65	74C912	8.95
4508	1.95	74C914	1.95
4510	.85	74C915	1.19
4511	.85	74C918	2.75
4512	.85	74C920	17.95
4514	1.25	74C921	15.95
4515	1.79	74C922	4.49
4516	1.55	74C923	4.95
4518	.89	74C925	5.95
4519	.39	74C926	7.95
4520	.79	74C927	7.95
4522	1.25	74C928	7.95
4526	1.25	74C929	19.95
4527	1.95	74C930	19.95

## Prices Slashed! 74S00

74S00	.32	74S163	1.95
74S02	.35	74S168	3.95
74S03	.35	74S169	3.95
74S04	.35	74S174	.95
74S05	.35	74S175	.95
74S08	.35	74S181	3.95
74S09	.40	74S182	2.95
74S10	.35	74S188	1.95
74S11	.35	74S189	6.95
74S15	.35	74S194	1.49
74S20	.35	74S195	1.49
74S22	.35	74S196	1.49
74S30	.35	74S197	1.49
74S32	.40	74S201	6.95
74S37	.88	74S225	7.95
74S38	.85	74S240	2.20
74S40	.35	74S241	2.20
74S51	.35	74S244	2.20
74S64	.40	74S251	.95
74S65	.40	74S253	.95
74S74	.50	74S257	.95
74S85	1.99	74S258	.95
74S86	.50	74S260	.79
74S112	.50	74S274	19.95
74S113	.50	74S275	19.95
74S114	.55	74S280	1.95
74S124	2.75	74S287	1.90
74S132	1.24	74S288	1.90
74S133	.45	74S289	6.89
74S134	.50	74S301	6.95
74S135	.89	74S373	2.45
74S138	.85	74S374	2.45



## LINEAR

LM301	.34	LM339	.99	NE564	2.95	LM1496	.85
LM301H	.79	LM340 (see 7800)		LM565	.99	LM1558H	3.10
LM307	.45	LM348	.99	LM566	1.49	LM1800	2.37
LM308	.69	LM350K	4.95	LM567	.89	LM1812	8.25
LM308H	1.15	LM350T	4.60	NE570	3.95	LM1830	3.50
LM309H	1.95	LM358	.69	NE571	2.95	LM1871	5.49
LM309K	1.25	LM359	1.79	NE592	2.75	LM1872	5.49
LM310	1.75	LM376	3.75	LM703	.89	LM1877	3.25
LM311	.64	LM377	1.95	LM709	.59	LM1889	1.95
LM311H	.89	LM378	2.50	LM710	.75	LM1896	1.75
LM312H	1.75	LM379	4.50	LM711	.79	LM2877	2.05
LM317K	3.95	LM380	.89	LM723	.49	LM2878	2.25
LM317T	1.19	LM380N-8	1.10	LM723H	.55	LM2900	.85
LM318	1.49	LM381	1.60	LM733	.98	LM2901	1.00
LM318H	1.59	LM382	1.60	LM741N-8	.35	LM3900	.59
LM319H	1.25	LM383	1.95	LM741N-14	.35	LM3905	1.25
LM319	1.25	LM384	1.95	LM741H	.40	LM3909	.98
LM320 (see 7900)		LM386	.89	LM747	.69	LM3911	2.25
LM322	1.65	LM387	1.40	LM748	.59	LM3914	3.95
LM323K	4.95	LM389	1.35	LM1014	1.19	LM3915	3.95
LM324	.59	LM390	1.95	LM1303	1.95	LM3916	3.95
LM329	.65	LM392	.69	LM1310	1.49	MC4024	3.95
LM331	3.95	LM394H	4.60	MC1330	1.69	MC4044	4.50
LM334	1.19	LM399H	5.00	MC1349	1.89	RC4136	1.25
LM335	1.40	NE531	2.95	MC1350	1.19	RC4151	3.95
LM336	1.75	NE536	6.00	MC1358	1.69	LM4250	1.75
LM337K	3.95	NE555	.34	LM1414	1.59	LM4500	3.25
LM337T	1.95	NE556	.65	LM1458	.59	LM13080	1.29
LM338K	6.95	NE558	1.50	LM1488	.69	LM13600	1.49
		NE561	19.95	LM1489	.69	LM13700	1.49

H = TO-5 CAN

T = TO-220

K = TO-3

## RCA

CA 3023	2.75	CA 3082	1.65
CA 3039	1.29	CA 3083	1.55
CA 3046	1.25	CA 3086	.80
CA 3059	2.90	CA 3089	2.99
CA 3060	2.90	CA 3096	3.49
CA 3065	1.75	CA 3130	1.30
CA 3080	1.10	CA 3140	1.15
CA 3081	1.65	CA 3146	1.85
		CA 3160	1.19

## TI

TL494	4.20	75365	1.95
TL496	1.65	75450	.59
TL497	3.25	75451	.39
75107	1.49	75452	.39
75110	1.95	75453	.39
75150	1.95	75454	.39
75154	1.95	75491	.79
75188	1.25	75492	.79
75189	1.25	75493	.89
		75494	.89

## BI FET

TL071	.79	TL084	2.19
TL072	1.19	LF347	2.19
TL074	2.19	LF351	.60
TL081	.79	LF353	1.00
TL082	1.19	LF355	1.10
TL083	1.19	LF356	1.10
		LF357	1.40

## VOLTAGE REGULATORS

7805T	.89	7905T	.99
7808T	.89	7908T	.99
7812T	.89	7912T	.99
7815T	.89	7915T	.99
7824T	.89	7924T	.99
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	7915K	1.49
7824K	1.39	7924K	1.49
78L05	.69	79L05	.79
78L12	.69	79L12	.79
78L15	.69	79L15	.79
78H05K	9.95	LM323K	4.95
78H12K	9.95	UA78S40	1.95

T = TO-220

K = TO-3

L = TO-92

## 5 1/4" DISK DRIVES

### TANDON

TM100-1 (FOR IBM)	229.00
TM100-2 (FOR IBM)	295.00

### SHUGART

SA 400L (40 TRACK)	199.95
SA 400 (35 TRACK)	189.95

### CABINET FOR 5 1/4" DISK DRIVE

- \* COLOR MATCHES APPLE
- \* FITS SHUGART

**SPECIAL — \$29.95**

## MICROCOMPUTER HARDWARE HANDBOOK

FROM ELCOMP — \$14.95

Over 800 pages of manufacturers data sheets on most commonly used IC's.

Includes:

- \* TTL — 74/74LS and 74F
- \* CMOS
- \* Voltage Regulators
- \* Memory — RAM, ROM, EPROM
- \* CPU's — 6800, 6500, Z80, 8080, 8085, 8086/8
- \* MPU support & interface — 6800, 6500, Z80, 8200, etc.

## WE NOW STOCK A COMPLETE LINE OF DISC, ELECTROLYTIC, MONOLITHIC AND TANTALUM CAPACITORS

## RESISTORS

1/4 WATT 5% CARBON FILM ALL STANDARD VALUES	
FROM 1 OHM TO 10 MEG OHM	
50 PCS. SAME VALUE	.025 EA.
100 PCS. SAME VALUE	.02 EA.
1000 PCS. SAME VALUE	.015 EA.

## BEST SELLING BOOKS

### OSBORNE/MC GRAW-HILL

Apple II User's Guide	14.95
CRT Controller's Handbook	9.95
68000 Assembly Language Programming	16.99
C-BASIC User Guide	15.00

### SYBEX

Your Your First Computer	8.95
The CP/M Handbook	14.95
The PASCAL Handbook	18.95
Microprocessor Interfacing Techniques	17.95

## VISIT OUR RETAIL STORE

★ NEW HOURS ★

NOW OPEN

**TUESDAY & THURSDAY  
EVENINGS TILL 9:00 P.M.**

# CHRISTMAS SPECIALS

## NASHUA 5 1/4" Diskettes

TOP QUALITY — LOW PRICE!

Single Sided, Single Density  
Soft Sector'd with Hub Ring

**\$19<sup>95</sup> BOX OF 10**

## NEWPORT PROSTICK

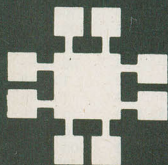
- ★ Professional Quality Atari-Type Joystick
- ★ Improve your scores — A must for maze games

**\$31<sup>00</sup> EACH**

- ★ Extremely Rugged — Actual Arcade game Joystick
- ★ All parts are replaceable

★ **6 Month Warranty**

**\$59<sup>95</sup> PAIR**



## JDR MICRODEVICES, INC.

1224 S. Bascom Avenue

San Jose, CA 95128

800-538-5000 • 800-662-6279 (CA)

(408) 995-5430 • Telex 171-110

© 1982 JDR MICRODEVICES, INC.

**VISIT OUR RETAIL STORE** — NEW HOURS —  
M-W-F, 9-5  
T-Th., 9-9 Sat. 11-3  
PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: For shipping include \$2 for UPS Ground or \$3 for UPS Blue Label Air. Items over 5 pounds require additional shipping charges. Foreign orders, include sufficient amount for shipping. There is a \$10 minimum order. Bay Area and Los Angeles Counties add 6% Sales Tax. Other California residents add 6% Sales Tax. We reserve the right to substitute manufacturer. Not responsible for typographical errors. Prices are subject to change without notice. We will match or beat any competitor's price provided it is not below our cost.



# THE ULTIMATE APPLE\*

## COOLING FAN \$69<sup>95</sup>

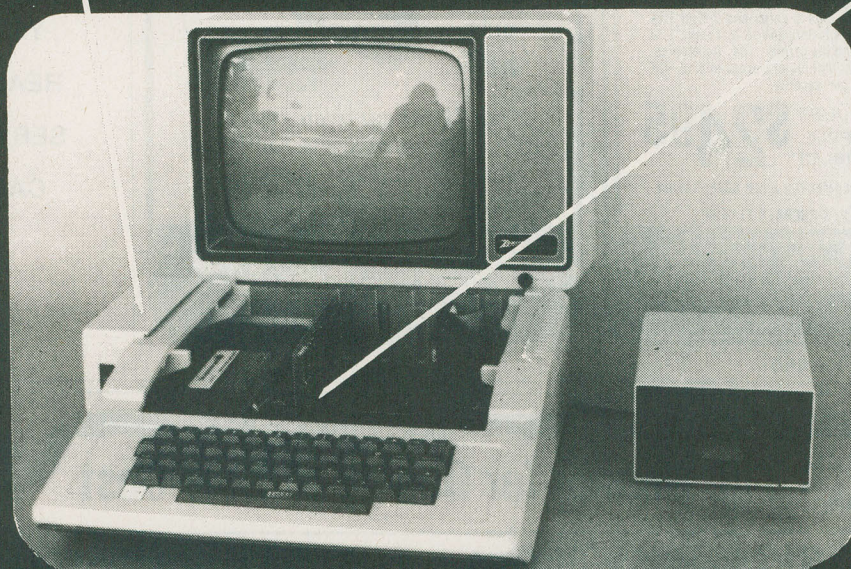
- ★ Easy Installation
- ★ No modification of Apple required.
- ★ Color matches Apple.
- ★ Switch on front controls fan, computer and monitor.
- ★ Ultra-quiet, reliable fan.
- ★ Completely eliminates problems caused by overheating

## 16K RAM CARD

- ★ Upgrade your 48K Apple II to full 64K of RAM.
- ★ Fully software and hardware compatible with the Apple language card and microsoft Z80 card.
- ★ Eliminates the need for the Applesoft or Integer Basic ROM card when used in conjunction with DOS 3.3.
- ★ Allows you to run Apple Fortran or Pascal with no difficulty.
- ★ Available as bare board, kit, or assembled and tested board.

## PRICE REDUCED

ASSEMBLED & TESTED ..... \$49.95  
BARE CARD ..... \$14.95      KIT ..... \$44.95



## DISK DRIVE \$299<sup>95</sup>

- ★ Includes metal cabinet
- ★ Color matches Apple
- ★ 35 Tracks/single side
- ★ Includes cable
- ★ Use with Apple II Controller

ORDER TOLL FREE

800-538-5000

800-662-6279

(CALIFORNIA RESIDENTS)



## MONITORS

NEC JB1201M \$169<sup>00</sup>

ZENITH ZUM-121 \$119<sup>00</sup>

COLOR

AMDEK COLOR I \$335<sup>00</sup>

NEC JC 1201M \$329<sup>00</sup>

## PRINTERS

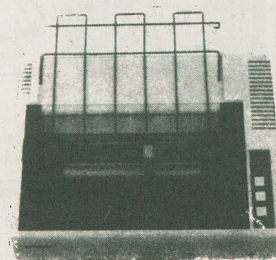
MX-80

MX-80FT

MX-100

CALL FOR PRICE

WE HAVE APPLE AND TRS-80  
INTERFACE CARDS AND CABLES



## SA400 35 TRACK DISK DRIVE CLEARANCE

- ★ VERY LIMITED SUPPLY
- ★ MODIFY FOR USE IN APPLE
- ★ PRE-REVISION "L" MODEL
- ★ THEY WON'T LAST LONG

**\$189<sup>95</sup>**

## 5 1/4" DISKETTES

ATHANA SS SD SOFT ..... 24.95

MEMOREX SS SD SOFT .... 26.95

VERBATIM SS SD SOFT .... 29.95

VERBATIM 10 SECTION HARD 29.95

© 1982 JDH MICRODEVICES, INC.

CIRCLE 46 ON FREE INFORMATION CARD



It's a  
Typewriter—  
It's a Printer!



Off-Lease  
Fully  
Reconditioned!

## \*"SELECTRIC" TYPEWRITER/PRINTER

Only  
**\$399<sup>00</sup>**

- 15" wide frame
- Modified "Selectric" I/O Machine
- Takes standard "golf-ball" type elements
- Full typewriter operation (except repeats)
- TTL input printer driven P.C. board
- Complete read switch assembly for feedback
- Fully Reconditioned

### Now Available!! "Centronics-input"

Complete plans for a Z-80 powered Centronics-type parallel input Selectric interface. Designed specifically for our "Selectric" typewriter/printer (above) uses only 9 chips and 2 K of 16K EPROM (the balance is for future RS-232 I/O). Easy to construct, needs only 24VDC @ 4 amps. 12V @ 1 amp and 5VDC @ 1 amp for full operation of the interface and the printer. The "Centronics-Type" parallel input accepts upper and lower case ASCII. Plans include pre-programmed 16K EPROM which allows printing of approximately 15 characters per second.

ALL FOR JUST **\$24<sup>95</sup>**  
NOW YOUR "SELECTRIC" CAN BE TRS-80, APPLE,  
AND OTHER MICROCOMPUTER COMPATIBLE!!

TRS-80, APPLE & SELECTRIC are trademarks of RADIO SHACK, APPLE COMPUTER & IBM CORPORATION

WRITE or CALL NOW for our EXCITING BARGAIN-PACKED PERIPHERALS FLYER!!!

**Computer  
UP** Products &  
Peripherals  
Unlimited

WAREHOUSE: 18 Granite St., Haverhill, Mass. 01830  
MAIL ORDERS: Box 204, Newton, New Hampshire 03858  
TELEPHONE ORDERS:  
**617/372-8637**  
Sorry, No Collect Calls  
MasterCard & VISA Accepted

CIRCLE 80 ON FREE INFORMATION CARD

## CABLE TV

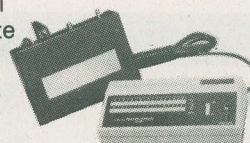
### CONVERTERS DESCRAMBLERS

Largest Selection  
of Equipment Available  
\$ Buy Warehouse Direct & Save \$



36 channel  
converter  
**\$45<sup>95</sup>**

36 channel  
wired remote  
converter  
only  
**\$88<sup>95</sup>**



Send \$2 for complete catalog  
of converters and unscramblers

Quantity Discounts • Visa • Master Charge  
Add 5% shipping—Mich. residents add 4% sales tax

**C&D Electronics, Inc.**  
P.O. Box 21, Jenison, MI 49428  
(616) 669-2440

DON'T  
FORGET



USE  
YOUR  
READER  
SERVICE  
CARD

## OMNITRON: The Source for Quality at Low Cost

Silicon  
H.V. Triplers

**HIGH VOLTAGE  
MULTIPLIERS**



### SYLVANIA Triplers

**ECG-500A**

212-139  
212-139-01  
212-139-02

**\$12<sup>95</sup> ea.**

**ECG-523**

212-141  
212-141-01

**\$15<sup>00</sup> ea.**

**ECG-526A**

212-141-02  
212-141-03  
212-141-04

**\$16<sup>99</sup> ea.**

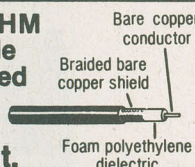
**REMEMBER!**  
Sylvania  
Tubes  
70% + 10%  
OFF  
LIST

**Sylvania ECG  
Replacement  
Semiconductors  
and Components**  
Full line in stock.  
The best quality  
semiconductor.

**RG-59/U 75 OHM  
Co-Axial Cable  
Copper Braided  
Shield**

White or Black

**\$44<sup>50</sup>/1000 ft.**



**F-59 Connector  
with Separate Ferrule  
10¢/100 lot**



**Matching Transformer  
75-300 Ohm  
59¢ ea. \$44<sup>00</sup>/100**



**2 Way - 75 Ohm Coupler  
MT-2 \$14<sup>ea.</sup> \$89<sup>00</sup>/100**



**2 SC1172B  
\$1<sup>99</sup>**

**VERY POPULAR**



**80 MFD x 450 Volts... .99  
100 MFD x 450 Volts...1.09**

**SOLDER (60/40 Rosin Core)**  
1 lb. - .062 dia.  
(regular size)  
**\$7<sup>99</sup> SOL-1**

**SOLDER WICK 99¢**  
Solder Removal SW-5  
1/2" Wide (Thick Type)-5 feet

**SILICON RECTIFIER 2.5 Amp/1000 PIV**  
**100/\$9<sup>95</sup> SL-100**

**GLOBAR DISC - 120 Ohms Cold**  
107191 RCA **99¢**

**10 ASSORTED CIRCUIT BREAKERS**  
10/\$7<sup>99</sup> Good Assortment  
CB-10

**CHEATER CORDS**  
Polarized C Clip  
Price: 39¢ 24620

**Standard C Clip**  
Price: 39¢ 24623

**REPLACEMENT RODS**

4 Section LAR-4 **69¢**  
5 Section LAR-5 **89¢**  
6 Section LAR-6 **99¢**  
7 Section LAR-7 **99¢**

**G.E. OM-300**

**\$149**  
**PANASONIC OM-500**  
**\$159**

# OMNITRON

**ELECTRONICS**

770 Amsterdam Ave., New York, NY 10025

► Also ask for Free 100 Page Catalog ◀

Send Purchase Order, Check or Money Order  
or Call Toll Free **800-223-0826**

in NY STATE (212) 865-5580

ALL ORDERS SHIPPED UPS/COD F.O.B., N.Y.C.

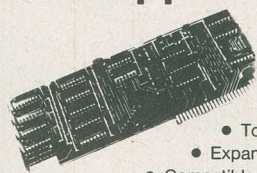
MASTER CARD • VISA



# ADVANCED COMPUTER PRODUCTS

SEND \$2.00 for 104 PAGE CATALOG

## 16K Apple™ Ramcard



LIST 195  
ACP  
\$69.95

- Full 1 year warranty
- Top quality — gold fingers
- Expand Apple II 48K to 64K
- Compatible with Z-80 Softcard™

• Allows system to run with CP/M™, PASCAL, DOS3.3, COBOL, Visicalc, etc.

• Supplied with extra 16K RAM & has (2) LED's

## 32K STATIC RAM

2 or 4 MHz  
Expandable  
Uses  
2114L's

16K 4 MHz Kit \$159.95  
16K 4 MHz A&T 217.95  
32K 4 MHz Kit \$199.95  
32K 4 MHz A&T 269.95  
BARE BOARD \$39.00  
Bare Bd w/all parts less mem. 99.95

## BARE BOARDS

S-100 Base Board \$34.95  
8080A CPU 34.95  
32K Static Ram (2114) 34.95  
8K EPROM (2708) 24.95  
2708/2716 EPROM 34.95  
ACP Proto Board 22.20  
Vector 8803 11 slot MB 29.95  
ACP Extender with connector 16.95  
12 Slot Mother Board (WMC) 32.95  
9 Slot Mother Board (WMC) 29.95  
S Slot Mother Bd (Expandable) 34.95  
Floppy PCB (8" SHUGART) 39.95  
S100 (A75-B910) Sound Board 34.95  
Apple Sound Board 24.95

## UV "EPROM" ERASER

Model UVs-11E  
\$79.95  
Holds 4 EPROM's at a time.  
Model S-52T \$325.00

## 16K Memory Expansion Kits for Apple/TRS-80

8 pcs 4116 16K  
200/250ns  
Specify computer  
CALL FOR VOLUME PRICING

## "D" SUB CONNECTORS

Unreal price. DB37 male, DB25 female. Gold PC mount with mounting holes. Mfg. AMP. Specify 25 or 37 pins.

BD37 \$2.50 DB25 \$1.95

## Astec RF Modulator

for COLOR & B/W  
P/N 1082 Channel 3 or 4 \$6.95

## 1200 BAUD MODEM IC

Features:  
• 1200 Baud  
• 40 Pin  
• 5Vdc Only  
SL1200 \$129.00

## PARALLEL ALPHA NUMERIC PRINTER

19 Column Printer prints 16 numerical columns plus 3 columns which have math, alpha and other notations. Each wheel has 12 positions with position 12 blank. Position 11 on numerical columns have decimal point or #. Utilizes 2.75" wide adding machine tape and a dual color ink ribbon. Input data parallel with four bit BCD computer circuit (schematic provided). Print rate, 3 lines per second. Operating voltage 22-28VDC with typical cycle time of 340ms. Size 6 1/2" W x 3 1/2" H x 5 1/2" Dp. New. \$17.50 ea. 3/\$45

## 64K CMOS RAM

S100 (200ns)  
Uses 2716's \$349.00  
or 6116's  
Assembled & Tested \$399.00

## MOSTEK 4K RAMS

29¢ ea.  
200,000 pieces in stock — priced to move. Same as MK4015 4Kx1 RAM.

## STEPPER MOTOR

Operates by applying 12VDC in one direction and then reversing polarity (or square wave). Uses 12VDC. Clock Wise Rotation. Rated 3 RPM at 4 P.P.S. with a 5 degree stepping angle.

ACP PRICE \$4.95 ea. 10 for \$39.95

## 4K STATIC RAM

SELL-OFF 10/\$9.90  
Same as TMS4044 but designed specifically for Z-80 based systems. This is a full-spec 4Kx1 RAM, 450ns. Order P/N Zilog 6104-4 while supply lasts.

## Zilog Z8 CPU

with TINY BASIC  
Debug prog. \$49.95  
Plus 6132 companion quasi-static RAM 29.95

## Stepper Motor

USED IN DATA PRODUCTS PRINTER  
\$19.95 ea.

## CONNECTORS

DB25P (RS232) \$3.25  
DB25S Female 3.75  
Hood 1.25  
Set with Hood, Sale 7.50  
22/44 S/T, KIM 2.95  
43/86 S/T, MOT 6.50  
50/100 S-100 Connector W/W 4.95  
50/100 S-100 Connector S/T 3.95

## MICROPROCESSORS

Z8001	\$99.00	8008-1	\$14.95	6802P	14.95
Z8002	69.00	2801A	9.90	8035	14.95
Z8003	9.95	2801A	14.95	8039	12.95
Z8004	11.95	9900UL	49.95	8073N	34.95
F-8 (3850)	16.95	6502	9.95	8755	49.95
2650	16.95	6502A	16.95	8748	49.95
1802	8.75	LM6100	29.95	6802P	30.00
8080A	4.75	6800	11.75	8086	49.95
8085	14.95	6800B	19.95	68000	129.95

## RAMS

6116/2016	\$7.95	2147	\$5.99	5290	\$1.99
8264-64K	8.50	411	5.99	5298	1.49
4116-2	1.99	414	4.69	6508	4.50
4116-2 8/12	1.99	1101	9.99	6518	6.79
2101	3.99	1103	9.99	6561	3.79
2102	.79	4027	4.69	6804	3.99
21L02-2	1.49	4044	3.99	6805	7.99
21L02-4	1.29	4050	4.69	9100	9.99
2111	3.49	4060	4.69	9140	9.99
2112	3.49	4096	3.99	93415	8.99
2114	1.99	4115	4.49	93425	6.99
2114L-2	3.25	4200	7.95		
2114L-4	2.29	4402	1.99		
2125	6.99	5280	4.60		

## SUPPORT

8155	\$9.95	8259	\$8.95	68047	\$22.95
8156	9.95	8275	19.95	68488	19.95
8202	29.95	8279	9.50	46505	22.95
8205	2.69	6810	4.75	6520	6.95
8212	2.75	6820	6.50	6522	9.95
8214	4.95	6821	6.50	6530-X	24.95
8216	2.75	6828	10.50	6532	17.95
8224	2.95	6834	16.95	6551	19.95
8226	2.95	6845	22.95	Z80-PIO	6.50
8228	3.95	6847	27.95	Z80A-PIO	9.50
8243	9.95	6848	5.25	Z80-CTC	6.50
8250	14.95	6852	5.25	Z80A-CTC	9.50
8251	6.50	6860	10.95	Z80-DMA	19.95
8253	11.95	6862	10.95	Z80-DMA	27.95
8255	4.50	6875	5.95	Z80-SIO	24.95
8257	9.50	6880	2.49	Z80A-SIO	29.95

## MOS PROMS

2764 (8Kx8) TS	\$69.95	2708 (450ns) TS	\$5.75
2732 (4Kx8) TS	12.95	2708 (650ns) TS	5.25
2716/2516; 5V	7.95	1702A	5.75
(2Kx8) TS	7.95	MM5203ACQ	14.50
TMS3716; 5V, 12V	17.95	MM5204Q	9.95
2758; 5V, (450ns)	3.50		

## HI-TECH

2513-001 (5V) Upper	\$9.50	DAC08	\$9.95
2513-005 (5V) Lower	10.95	DAC100	9.95
2513-ADM3 (5V) Lower	14.95	8038 Function Generator	9.95
MCM66710 ASCII Shifted 125	1.95	MC4024 VCO	1.95
MCM66740 Alpha Control 13.45	1.95	MC4024 VCO	1.95
MCM66750 Alpha Control 13.45	1.95	XR2206 Function Generator 5.25	
1771-01 8" & MiniFloppy 24.95		TR16028 (5V, 12V)	3.95
1781 Dual Floppy 36.95		AVS1013 (5V, 12V)	4.95
1791-01 Dual Floppy 36.95		AVS1014A (12V 15-14V)	6.95
1791-02 Dual Floppy 44.95		AVS1015A (16V 15V)	6.95
1793 DD, DS Floppy 44.95		IM6402	7.95
1797 DD, DS Floppy 54.95		IM6403	9.95
1900 Data Separator 18.95		2250 USRT	8.95
2143 Clock Generator 18.95		15714 Attos	24.95
8700 8 bit Binary 13.50		MC14411	11.95
8701 10 bit Binary 22.00		4702	14.95
8703 8 bit TS 13.50		WD1941	16.95
9400 Volt to Freq Conv. 7.25		CM5016	9.95
8750 3 1/2 Bit BCD 13.95		IN6350	15.95
1408L 8 bit 3.95		AVS-2376	13.75
1408L 8 bit 5.95		AVS-3600	13.75
DAC010 to A 5.95		MM5740AAC	8.95

## SOCKETS

8 pin LP	.16	.15	.14
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.29	.27	.24
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
40 pin LP	.60	.59	.58

## LOW PROFILE SOCKETS (TIN)

8 pin WW	.55	.54	.49
14 pin WW (Tin)	.65	.63	.58
14 pin WW	.75	.73	.67
16 pin WW	.80	.77	.70
18 pin WW	.95	.90	.81
20 pin WW	1.15	1.08	.99
22 pin WW	1.45	1.35	1.23
24 pin WW	1.35	1.26	1.14
28 pin WW	1.60	1.53	1.38
40 pin WW	2.20	2.09	1.89

## 3L WIREWRAP SOCKETS (GOLD)

8 pin WW	.55	.54	.49
14 pin WW (Tin)	.65	.63	.58
14 pin WW	.75	.73	.67
16 pin WW	.80	.77	.70
18 pin WW	.95	.90	.81
20 pin WW	1.15	1.08	.99
22 pin WW	1.45	1.35	1.23
24 pin WW	1.35	1.26	1.14
28 pin WW	1.60	1.53	1.38
40 pin WW	2.20	2.09	1.89

## SUPER IC CLOSETOUT SPECIALS

ULN2003	2/81.99	2N6121	3/81.00	8080A CPU	2.95	5027 CRT	\$9.95
74LS668	3/1.99	5G12652	3.95	2102 RAM	1.49	11C24	6.95
74LS377	2/1.99	74LS287	1.95	4080 RAM	1.49	8255	2.99
74LS241	2/1.99	2758 EPROM	2.95	8X300 CPU	14.95	MM5320	5.99
8259	6.95	74173/8T10	5/1.99	74LS387	1.96	9131 RAM	1.99
6561 RAM	2.95	280A CPU	4.95	2708 EPROM	8/29.95	EMM4402	1.99
LM733CN	3/1.99	6522	6.95	2114	3/1.00	1103 RAM	3/1.50
MC14114	3/1.99	6502 CPU	6.95	8700 A/D	2/16.95		

\* CPM trademark of Digital Research. Apple trademark of Apple Computer.

TOLL FREE  
800-854-8230  
TWX  
910-595-1565

## LINEAR

78H05K	\$5.95	LM1414N	\$1.90
78M06	1.49	LM1458CN/N	.49
78M06	1.49	MC1488N	.99
LM1084H	2.95	MC1489N	.99
LM300H	.99	LM1469A	.99
LM301CN	.35	LM1556N	1.50
LM304H	1.98	LM1820N	.95
LM305H	1.89	LM1850N	.95
LM306H	3.25	LM1889N	3.10
LM307CN	.29	LM2111N	1.75
LM308CN	.98	LM2900N	.99
LM309K	1.49	LM2901N	2.50
LM310CN	1.25	LM2917N	2.95
LM311D/CN	.89	CA3013T	2.19
LM312H	1.75	CA3018T	1.99
LM317T	1.70	CA3021T	3.49
LM318CN	1.49	CA3023T	2.99
LM319H/N	1.25	CA3035T	2.75
LM320K-XX*	1.36	CA3039T	1.29
LM320T-XX*	1.39	CA3046N	1.29
LM320T-XX*	1.25	CA3053N	1.49
LM323K	4.95	CA3059N	3.19
LM324N	.95	CA3060N	3.19
LM337K	5.95	CA3062N	4.95
LM338K	6.95	LM3065N	1.49
LM339H	1.95	CA3080T	1.29
LM340K-XX*	1.45	CA3081N	1.45
LM340T-XX*	1.25	CA3082N	1.69
LM344H	1.25	CA3083N	1.55
LM344H	1.95	CA3086N	.80
LM348H	1.20	CA3089N	2.99
LM350K	9.80	CA3096N	3.49
LM358CN	.98	CA3097N	1.99
LM360N	1.49	CA3130T	1.30
LM372N	1.95	CA3140T	1.19
LM376N	3.75	CA3146N	2.49
LM379N	1.25	CA3160T	1.19
LM380CN/N	1.25	CA3160T	1.19
LM381N	1.79	CA3410N	.59
LM383T	1.95	MC3423N	1.49
LM386N	1.25	MC3460N	3.95
LM390N	1.40	SG3524N	3.95
LM390N	1.40	SG3524N	3.95
NE531V/T	3.75	LM3900N	.59
NE555V	.39	LM3905N	1.19
NE556N	.98	LM3909N	.98
NE561T	19.95	LM3914N	3.75
NE567H/V	1.75	LM3915N	3.95
NE569H/V	1.75	LM3916N	3.75
NE567H/V	1.50	RC4131N	2.95
NE592N	2.75	RC4136N	1.10
LM702H	1.99	RC4151N	3.70
LM708H/V	.29	RC4194TK	4.95
LM710H/V	.75	RC4194TK	5.40
LM711H/V	.39	ULN2001	1.25
LM715N	1.95	ULN2003	1.25
LM723H/V	.65	SN75450N	.59
LM733H/V	.98	SN75451N	.35
LM736N	1.15	SN75452N	.49
LM741CN-14	.33	SN75463N	.49
LM741CN-14	.19	SN75454N	.49
LM747H/V	.75	SN75491N	.89
LM748H/V	.39	SN75492N	.89
LM760CN	2.95	SN75493N	.89
LM761H/V	1.95	SN75494N	.89



# KNAPCO

**G.E. MOV Spike Eliminators**  
10/\$9.90 \$1.29

**Cabinet**  
Black Metal  
2 1/2" X 4" X 2" High  
100/\$85.00

**Chassis (H.D.)**  
4" X 8" X 2 1/4" H.  
100/\$65.00

**115 V. BLOCK FANS**  
3" SQ.  
# FAN 31 \$6.95

**ULTRASONIC BUG ELIMINATOR**  
IC BASE CIRCUITRY WITH PIEZO  
ALL COMPONENTS —  
ELIMINATE COCKROACHES,  
FLEAS, BUGS.  
KIT \$14.95

**Dual Computer Chip Set**  
2 CPU & MPU Systems/Dual -  
Clocks, ACU, 512 X 8 Bi Polar Ram 50 usec.  
& support  
R 29623 Bi Polar Ram  
74LS624 Volt Cont. Osc.  
74121 (2) 74123 (2)  
29701 64 X 8 Prom  
MC 8601 Monostable, Retrig.  
Multivibrator (2)  
CA 3246 Quad 20 MA. OP AMP.  
6503 CPU  
8048 MPU  
723 Reg.  
TMS 9901 Prog. Keyboard Interface

**ITT Power Supply**  
Triple or Dual  
± 2% Low Ripple  
Choice Of  
+12V. 7A -12V 7A  
or 24V. 7A.  
And 5V. 10A.  
\$300.00 Orig. Teletype Cost  
5" X 5" High X 14" \$59.95

**Power Inverter**  
12V. to 115V.  
450 Watt  
\$79.95

**2 1/2" Meters**  
Choice Of  
Any 1  
0-15 VDC  
0-20 VDC  
0-150 VAC  
30-0-30 DCA  
0-15 DCA  
10/\$30.00

**Tri-Color LEDs**  
Red/Green reverse volt.  
Yellow A.C.  
2/\$1.50

**Transformer**  
30V. CT. 1.5 AMP.  
10/\$22.00 100/\$200.00

**TRANSFORMERS**  
TR 79 MULTI-TAPS  
6, 7, 9, 12's @ 1 to 1.7 A., 10V./8 A.  
+ 46 V./2.5 A. C.T. \$6.95  
TR 97  
6.5V./4 A., 16 V./5 A.,  
30V./3A., 17V./30A. C.T. \$23.95

**General Instrument Varactor Tuners**  
Your Choice Mitsumi  
VHF - UHF  
\$22.50

**Voltage Regulators**  
+5V. 7805  
-5V. 79M05  
+6V. 7806  
+12V. 7812

**MOTOROLA PIEZO SPEAKERS**  
3/4" RESPONSE  
60 TO 30,000 Hz  
\$6.95

**Toko 10.7 MHZ. Xtal Filter & Coil**  
10 pairs \$9.95  
100 pairs \$89.50

**Piezo Elements**  
Fantastic  
Murata Transducer  
\$39.00

**WORK HOLDER**  
6 UNIVERSALS  
HEAVY BASE  
ALLIGATOR CLIPS  
\$6.95

**Heat Sinks**  
7 TO-3 14" X 4" X 1 1/4" HT.  
5 TO-3 10" X 4" X 1 1/4" HT.  
4 TO-3 6.5" X 3.5" X 1 1/4" HT.  
1 TO-220 4" X 1 1/4" HT.  
\$9.95

**Specialty Chips**  
IM4402 Uarts \$4.95  
MC10125P Bus Driver \$3.50  
N82S123F Prom 256X8 \$1.59  
4164-15N. 8.50 Ram 64K  
MM1702 13.95 Eprom  
4116 200NS. 8/15.50 Ram  
8080A CPU \$1.95

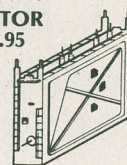
**SEND FOR FREE 1982 CATALOG**  
or call us at  
(813) 392-0406

**add 10% for shipping and handling min. shipping charge \$2.50**  
**H.J. Knapp of Florida, Inc.**  
4750 96th St. N. St. Petersburg, Florida 33708

CIRCLE 67 ON FREE INFORMATION CARD

## MORE GAIN Than a Mitsumi Tuner PHILIPS VARACTOR TUNER — \$23.95

MODEL ELC 1045  
FREQ. RANGE  
UHF 470-889 MHZ  
CHANNEL 14-83  
OUTPUT CHANNEL 3  
75 OHM INPUT



Part No.	Description	Price
DSW10	Philips UHF Tuner ELC 1045	\$23.95
DSW20	Printed Circuit Board, Predrilled	\$15.00
DSW30	Glass Epoxy	\$5.95
DSW40	P.C.B. Potentiometers 5-10K, 1-5K	\$4.95
DSW50	Resistor Kit 1/4 watt 5%	\$4.95
DSW60	Carbon Resistors 32 pcs.	\$2.95
DSW70	Panel Mount Potentiometers	\$2.95
DSW80	2-10K and Knobs	\$15.95
DSW90	IC's 7 pcs., 1 Rectifier	\$4.95
DSW100	2 Regulators & 1 Heat Sink	\$6.95
DSW110	Electrolytic Cap Kit, 33 pcs.	\$3.95
DSW120	Ceramic Cap Kit, 4 pcs.	\$1.95
DSW130	Variable Trimmer Kit, 4 pcs.	\$4.95
DSW140	Coil Kit, 2-18 uh, 1 variable 33 uh + 1 - + 37-12 Toroid + 26 wire	\$5.95
	1 C. Sockets 5-8 pins, 2-14 pin	\$3.00
	Power Transformer	\$7.95
	PR1-117Vac, SEC 24Vac, 1 amp	\$5.95
	Speaker, Oval 8 ohm	\$2.95
	Misc. Parts, Hardware & Hookwire	
	Ant. Term, Switch Dpdt, Fuse, Fuseholder, Line Cord, etc.	

When Ordering All Items

DSW10-D140 Total Price \$99.95

## R.F. Modulator

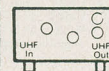


Combine both audio and video output onto channel 3 or 4 of your T.V. set.

Single I.C. chip (MC 1374) makes for quick and easy assembly. Single adjustment control! A must for every video recording or computer enthusiast.

VH-0 Kit \$19.95

## NEW & IMPROVED UHF T.V. Preamp



**Features:**  
• 25 dB gain!  
• Kit

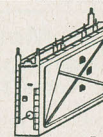
Your reception will dramatically improve! This unit will enable you to pull in signals you never knew were there!

For both indoor and outdoor use. Input and output impedance 75 ohm. No adjustment! Easy assembly.

JH-0 Kit \$22.95



## PWD KIT!!!



Part No.	Description	Price
PWD10	Philips UHF Tuner ELC 1045	\$23.95
PWD20	Glass Epoxy Circuit Board, Predrilled	\$16.95
PWD30	P.C.B. Pots, 4-20K, 2-1K, 2-10K,	\$9.95
PWD40	2-100K	\$4.95
PWD50	Resistor Kit 1/4 watt 5%	\$4.95
PWD60	Panel Mount Pots 2-5K	\$3.95
PWD70	IC's 7 pcs., 1 Rectifier,	\$11.95
PWD80	2-Heat Sinks & Sockets	\$11.95
PWD90	Ceramic Disc Caps — 37 pcs & Misc. Type Capacitors	\$5.95
PWD100	Electrolytic Caps 18 pcs.	\$4.95
PWD110	Variable Trimmer Capacitor 5- 5-35 pF	\$2.95
PWD120	Coil Kit, 2-T37-12 Ferrite cores Toroid 4-Prewound Indicators	\$2.95
PWD130	Misc. Parts—Hookup Wire, Ant. Terminals, Fuse, Fuseholder	\$8.95
PWD140	Dpdt Switch, Line Cord etc.	\$5.95
PWD150	Power Transformer	\$2.95
PWD160	Primary-117 Vac, Secondary 24 Vac, 1 amp	\$13.95
PWD170	Speaker, Oval 8 ohm	
PWD180	Cabinet, Prepunched & Drilled	

When Ordering All Items

PWD10-PWD140 Total Price \$124.95

Available by Mail Order only  
Send check or money order to

**STAVIS ELECTRONICS, INC.**  
912 W. Touhy Avenue  
Park Ridge, Illinois 60068  
(312) 564-0104

Minimum order \$15.00. Add 10% shipping on orders under \$35.00. Orders over \$35.00, add 5%.  
Catalog - \$1.00. Visa & Mastercard acceptable

CIRCLE 71 ON FREE INFORMATION CARD

## Burglar/Fire Alarms

# FREE CATALOG

over 2000 products  
free technical  
and assistance

CCTV controls  
alarm systems  
passive infrareds  
motion detectors  
ultrasonic detectors  
magnetic contacts  
smoke detectors  
vehicle alarms  
accessories  
remotes  
tools

**mountain west™**  
4215 N. 16th Street Dept. RE-12  
Phoenix, AZ 85016  
1-800-528-6169 toll-free

## USE YOUR WILL POWER TO FIGHT CANCER

For information about  
bequests, call the  
**AMERICAN CANCER SOCIETY**

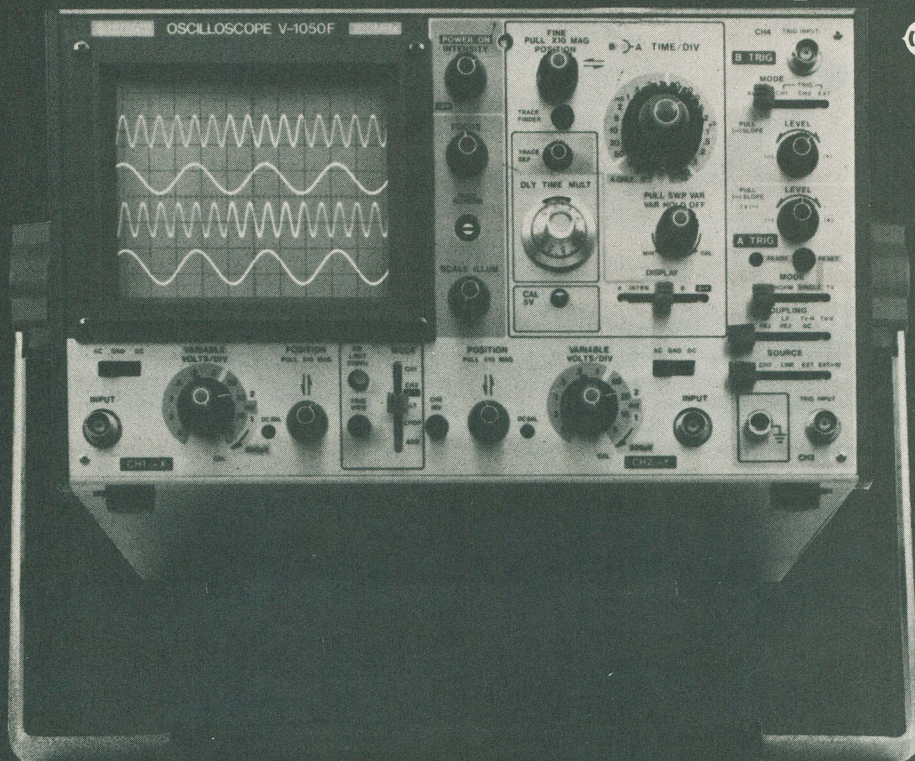
THIS SPACE CONTRIBUTED AS A PUBLIC SERVICE

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685)			
1. TITLE OF PUBLICATION	2. ISSUE DATE	3. NUMBER OF ISSUES PUBLISHED ANNUALLY	4. DATE OF FILING
RADIO-ELECTRONICS	October 1, 1982	12	October 1, 1982
5. FREQUENCY OF ISSUE	6. NUMBER OF COPIES OF THIS ISSUE	7. ANNUAL SUBSCRIPTION PRICE	
Monthly	12	\$13.00	
8. COMPLETE MAILING ADDRESS OF KNOWN OFFICE OF PUBLICATION (Street, City, County, State and ZIP Code, if possible)			
200 Park Ave. South, New York, NY 10003			
9. COMPLETE MAILING ADDRESS OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICE OF THE PUBLISHERS (If not same as 8)			
200 Park Ave. South, New York, NY 10003			
10. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER, EDITOR AND MANAGING EDITOR (If not same as 8 or 9)			
PUBLISHER: Arthur Elmslie, 200 Park Ave. South, New York, NY 10003			
EDITOR: Larry Steckler, 200 Park Ave. South, New York, NY 10003			
MANAGING EDITOR: H. Harvey Gensbach, 200 Park Ave. South, New York, NY 10003			
11. OWNER (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a corporation, its name and address must be stated. If the publication is published by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.			
PUBLISHER: Arthur Elmslie, 200 Park Ave. South, New York, NY 10003			
EDITOR: Larry Steckler, 200 Park Ave. South, New York, NY 10003			
MANAGING EDITOR: H. Harvey Gensbach, 200 Park Ave. South, New York, NY 10003			
12. KNOWN BONDHOLDERS, MORTGAGEES AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES OF PUBLISHER (If none, so state)			
None			
13. FOR COMPLETION BY NONPROFIT ORGANIZATIONS AUTHORIZED TO MAIL AT SPECIAL RATES (Section 3626, 3627, 3628, 3629, 3630, 3631, 3632, 3633, 3634, 3635, 3636, 3637, 3638, 3639, 3640, 3641, 3642, 3643, 3644, 3645, 3646, 3647, 3648, 3649, 3650, 3651, 3652, 3653, 3654, 3655, 3656, 3657, 3658, 3659, 3660, 3661, 3662, 3663, 3664, 3665, 3666, 3667, 3668, 3669, 3670, 3671, 3672, 3673, 3674, 3675, 3676, 3677, 3678, 3679, 3680, 3681, 3682, 3683, 3684, 3685, 3686, 3687, 3688, 3689, 3690, 3691, 3692, 3693, 3694, 3695, 3696, 3697, 3698, 3699, 3700, 3701, 3702, 3703, 3704, 3705, 3706, 3707, 3708, 3709, 3710, 3711, 3712, 3713, 3714, 3715, 3716, 3717, 3718, 3719, 3720, 3721, 3722, 3723, 3724, 3725, 3726, 3727, 3728, 3729, 3730, 3731, 3732, 3733, 3734, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3742, 3743, 3744, 3745, 3746, 3747, 3748, 3749, 3750, 3751, 3752, 3753, 3754, 3755, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3764, 3765, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3779, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 3787, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, 3796, 3797, 3798, 3799, 3800, 3801, 3802, 3803, 3804, 3805, 3806, 3807, 3808, 3809, 3810, 3811, 3812, 3813, 3814, 3815, 3816, 3817, 3818, 3819, 3820, 3821, 3822, 3823, 3824, 3825, 3826, 3827, 3828, 3829, 3830, 3831, 3832, 3833, 3834, 3835, 3836, 3837, 3838, 3839, 3840, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3848, 3849, 3850, 3851, 3852, 3853, 3854, 3855, 3856, 3857, 3858, 3859, 3860, 3861, 3862, 3863, 3864, 3865, 3866, 3867, 3868, 3869, 3870, 3871, 3872, 3873, 3874, 3875, 3876, 3877, 3878, 3879, 3880, 3881, 3882, 3883, 3884, 3885, 3886, 3887, 3888, 3889, 3890, 3891, 3892, 3893, 3894, 3895, 3896, 3897, 3898, 3899, 3900, 3901, 3902, 3903, 3904, 3905, 3906, 3907, 3908, 3909, 3910, 3911, 3912, 3913, 3914, 3915, 3916, 3917, 3918, 3919, 3920, 3921, 3922, 3923, 3924, 3925, 3926, 3927, 3928, 3929, 3930, 3931, 3932, 3933, 3934, 3935, 3936, 3937, 3938, 3939, 3940, 3941, 3942, 3943, 3944, 3945, 3946, 3947, 3948, 3949, 3950, 3951, 3952, 3953, 3954, 3955, 3956, 3957, 3958, 3959, 3960, 3961, 3962, 3963, 3964, 3965, 3966, 3967, 3968, 3969, 3970, 3971, 3972, 3973, 3974, 3975, 3976, 3977, 3978, 3979, 3980, 3981, 3982, 3983, 3984, 3985, 3986, 3987, 3988, 3989, 3990, 3991, 3992, 3993, 3994, 3995, 3996, 3997, 3998, 3999, 4000			



# When QUALITY counts...

...at competitive prices.

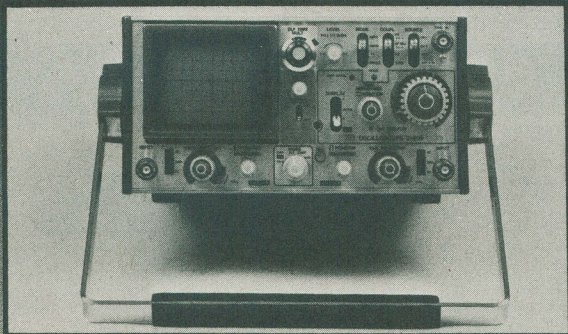


**Hitachi**

## V-1050F

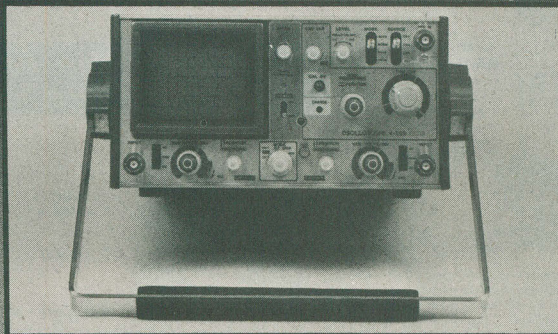
**100MHz, QUAD TRACE  
DELAYED SWEEP**

- Channel 1 Output for DVM or DMM Large, Bright 8 × 10 CM Screen
- High Accuracy  $\pm 2\%$  (+10 to +35°C)
- High Sensitivity: 500  $\mu$ V/div (5 MHz)
- Alternate Time Base Operation
- Automatic Focus
- Variable Hold-off
- Full TV Triggering (H, V)
- 20 MHz Bandwidth Limiter
- Delay Line for Viewing Leading Edge of Signal
- X - Y Operation (CH 1: Horiz., CH 2: Vert.)
- Trace Finder



### V-509 Delayed Sweep DC-50 VHz Mini-Portable Dual Trace

**FEATURES:** • 3.5" Rectangular CRT • Sensitivity 1 mV/div. (10 MHz) • Sweep Times to 10 ns/div. • Individual Sweep Time Controls (A, B) • Full TV Triggering (H, V) • CH 1 Signal DVM Output • Single Sweep • Variable Hold-off • X - Y Display Mode • Three Way Power Supply • Optional Battery Pack Available



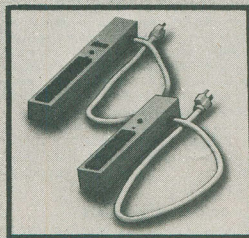
### V-209 DC-20 MHz Mini-Portable Dual Trace

**FEATURES:** • 3.5" Rectangular CRT • High Sensitivity (1mV/div. at 10 MHz) • Fast Sweep Times (50ns/div.) • Accuracy  $\pm 3\%$  (+ 10 to 35°C) • Z Axis Input • X - Y Display Mode • Auto Focus • Three Way Power Supply - Take Anywhere • Full TV Triggering • Human Engineered Front Panel • Calibrator 0.5 V  $\pm 1\%$

FROM THE SOUTHWEST'S OLDEST HITACHI DISTRIBUTOR



**DMM'S**  
D-802 Multimeter  
Shown



## SURGE STOPPER

Protect Your  
Solid State Equipment  
UL Listed  
MD6-3; MD4-3 Shown

**SJB DISTRIBUTORS, INC.**  
10520 PLANO ROAD, SUITE 206  
DALLAS, TEXAS 75238



**CALL TOLL FREE:**  
800-527-4893 (OUTSIDE TEXAS)  
800-442-1048 (TEXAS)  
214-343-1328 (DALLAS)





# FORMULA INTERNATIONAL INC.

12603 CRENSHAW BOULEVARD • HAWTHORNE, CALIFORNIA 90250 • (213) 973-1921



## PERFECT GIFT! LOW PRICE

HIGH QUALITY WATCHES & PEN WATCHES!

- A Mechanical, Yellow Case, Blk PVC Band \$16.50 ea.
- B Digital, Smurf, Blue, Yellow, Pink & Red \$9.95 ea.
- C Digital, Lady's Quartz, White, Burgandy, Blue, Tan \$9.95 ea.
- D Penwatch, Cross Look-alike, Stainless Steel \$9.95 ea.

ALL WATCHES HAVE 60 DAYS WARRANTY

## PROFESSIONAL FM WIRELESS MICROPHONE

Made by one of the leading Japanese manufacturers. This factory assembled FM wireless microphone is powered by two AA size batteries. It transmits in the range of 88-108 MHz. Element is built in a plastic tube type case with an omni-directional electronic condenser microphone unit. By using a standard FM radio, signal can be heard anywhere on a one-acre lot. Sound quality was judged "very good." MODEL WEM-36.

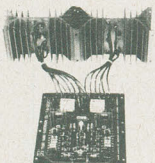
ON SALE

WAS \$16.50 \$12.50 each

## GOOD NEWS FOR HI-FI NUTS!

Introducing our TA-2000 200 watts P.P. Super Mirror Amplifier Kit.

By using four stages of modern P.P. Super Mirror Circuit, THD and TIM are kept under 0.01% at rated output! SPECIFICATIONS: 200W RMS into 4 or 8Ω



- 0 to 100,000 Hz (at 1W) +0dB, -1dB
- S/N better than 100dB
- Less than 0.01% total Harmonic Distortion.

MODEL TA-2000  
\$83.95 per kit

No FCC License Required.  
OUR PRICE \$49.50  
Additional Microphone (Transmitter) Available AT \$28.00 each  
MURA WMS-49

## CRYSTAL CONTROLLED WIRELESS MICROPHONE SYSTEM

Transmitter: FET mic for flat 30Hz-18KHz response. X'tal controlled 49 MHz AM Band for drift-free performance. 100 MW output (range approx. 1/4 mile) for reliable long range transmission. Powered by a 9V radio battery (included). Receiver: X'tal controlled locks on 49 MHz transmitter signal. On panel VU meter, monitors the signal strength from the microphone. Standard phone jack outlet connection to a P.A. or other phone input. 9V battery included. This professional set is ideal for on stage, in field, church, in house or outdoor use.



on 49 MHz transmitter signal. On panel VU meter, monitors the signal strength from the microphone. Standard phone jack outlet connection to a P.A. or other phone input. 9V battery included. This professional set is ideal for on stage, in field, church, in house or outdoor use.

## SANYO ANTENNA SIGNAL BOOSTER

This Booster is specially designed for UHF Channels (14-83). After installing (between the antenna input cable and the UHF tuner), this unit will provide a minimum of 10dB gain, that is approximately 2 times better than you are seeing now. Ideal for those who live in apartments that can not put up an outdoor antenna. Small in size, only 2" x 1 1/4" x 1". Supply voltage is 15 VDC. Back In Stock.



★ NEW ITEM ★  
MODEL 001-0076  
\$12.50 ea.

## HYBRID AUDIO POWER AMPLIFIER IC's

From 7 WATTS to 100 WATTS

Typical ratings: Operating case temp. 85°C. T.H.D.=0.5% @ 20Hz-20KHz. Input resistance Po=0.1W/30KΩ. Power band width 20Hz-20KHz. Freq. response 10-100KHz. Output resistance=8Ω. With built-in protection circuit. All units come with data sheet.

## WHISTLE ACTIVATED SWITCH BOARD

All boards are pre-assembled and tested. Your whistle to its FET condenser microphone from a distance, as far as 30 feet away (sensitivity can be easily adjusted), will turn the switch on and if you whistle again, it will turn off. Ideal for remote control toys, electrical appliance such as lights, coffee pot, TV, Hi-Fi, radio or other projects. Unit works on 9VDC.

MODEL 968 \$4.50 ea.

## SOLAR CELLS

0.5V 200MA. Ideal for all kinds of solar projects, cells can be put in series to double voltage or parallel to double current. \$1.99 ea.

## SANYO UHF VARACTOR TUNER

FOR UHF CHANNEL 14-83

Tuning voltage +1-28VDC. Input impedance 75Ω. IF band width 7-16MHz. Noise figure 11.5dB Max. Size 2 1/4" x 1 1/4" x 1/4". Supply voltage 15VDC.

Model 115-B-405A, Video IF 62.5MHz  
Model 115-B-405A, Video IF 45.0MHz  
\$35.00 ea.

Tuner is the most important part of the circuit. Don't let those \$19.00 tuners fool you. All units are brand new from Sanyo. When ordering please specify model number.



## REGULATED DUAL VOLTAGE SUPPLY KIT

±10-30 VDC @ 250 ma adjustable, fully regulated. Kit includes all electronic parts, filter capacitors, IC's, heat sinks and PC Board.

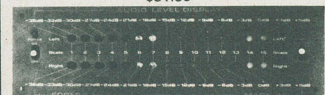
\$12.50 per kit

## MARK IV - 15 STEP

### LED POWER LEVEL INDICATOR KIT

This new stereo level indicator kit consists of 36 4-color LED's (15 per channel) to indicate the sound level output of your amplifier from -36dB to +3dB. Comes with a well designed silk screen printed plastic panel and has a selector switch to allow floating or gradual output indicating. Power supply is 6-12VDC with THG on board input sensitivity controls. This unit can work with any amplifier from 1W to 200W! Kit includes 70 pcs driver transistors, 38 pcs matched 4-color LED's, all other electronic components, PC Board and front panel.

MARK IV KIT  
\$31.50



## ELECTRONIC SWITCH KIT

CONDENSER TYPE. Touch On - Touch Off. Uses 7473 IC and 12V relay \$5.50

## POWER SUPPLY KIT

0-30VDC REGULATED. Uses UAT23 and 2N3055 power transistor. Output can be adjusted from 0-30V @ 2A. Complete with PC Board and all electronic parts.

TRANSFORMER \$9.50 ea.

## POWER SUPPLY KIT \$10.50 ea.

## FLUORESCENT LIGHT DRIVER KIT

12V DC Powered... Lights up 8-15 Watt Fluorescent Light Tubes. Ideal for camper, outdoor, auto or boat. Kit includes high voltage coil, power transistor, heat sink, all other electronic parts and PC Board. Light tube not included.

\$6.50 Per Kit

## ELECTRONIC DUAL SPEAKER PROTECTOR

Cuts off when circuit is shorted or over loaded to protect your amplifier as well as your speakers. A must for OCL circuits. KIT FORM \$8.75 ea.

## NEW ARRIVALS

### 6-WAY A/C ADAPTOR

Input: 110VAC Output: 3V, 4.5V, 6V, 7.5V & 12VDC  
Current: 300mA.

OUR LOW PRICE

\$5.50 each

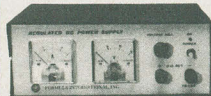
### 19" RACK MOUNT CABINETS

Black anodized front panel with black textured case.

WIDTH	DEPTH	HEIGHT	PRICE
17"	11 1/2"	3"	\$25.50
17"	11 1/2"	5"	\$31.50
17"	11 1/2"	7"	\$39.50

## PROFESSIONAL REGULATED VARIABLE DC POWER SUPPLY KIT

All solid state circuitry with high efficiency power transistor 2SD386 and IC voltage regulator MC1733. Output voltage can be adjusted from 0-30V at 1A current limited or 0-15V at 2A current limited. Internal resistance is less than 0.005Ω, ripple and noise less than 1mV, dual on panel meters for voltage and amp reading, also with on board LED and audible over load indicator. Kit comes with pre-drilled PC Board, instructions, all necessary electronic components, transformer and a professional looking metal cabinet. The best project for school and the most useful instrument for repairmen. Build one today!



MODEL TR88A  
0-15VDC @ 2A  
MODEL TR88B  
0-30VDC @ 1A

\$59.50 Per Kit

## SUPER FM WIRELESS MIC KIT - MARK III

This new designed circuit uses high FREQ FET transistors with 2 stage pre-amp. Transmits FM range (88-120MHz) up to 2 blocks away and with the ultra sensitive condenser microphone that comes with the kit allows you to pick up any sound within 15 ft. away. Kit includes all electronic parts. OSC coils and PC Board. Power supply 9VDC.

FMC-105

\$11.50 Per Kit

## FLUORESCENT AUDIO LEVEL MONITOR

This is the kind of VU monitor that is being used by most amplifier manufacturers. IC's are used to simplify circuit layout. Easy to assemble and can be used with all power level amplifiers. Power requirement 12VDC.

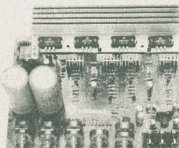


TE-221 KIT  
For Just \$28.50  
(Limited Stock)

## FOR INFORMATION CALL (213) 973-1921

## OUTSIDE CALIFORNIA PHONE ORDERS ONLY

## CALL TOLL FREE 1-800-672-8758



A GOOD BUY  
at \$65.00

TA-800

## 120W PURE DC POWER STEREO AMP KIT

Getting power hungry from your small amp? Have to watch your budget? Here's a good solution! The TA-800 is a pure DC amplifier with a built in pre-amp. All coupling capacitors are eliminated to give you a true reproduction of the music. On board tone and volume controls combined with built in power supply make the TA-800 the most compact stereo amp available. Specifications: 60W x 2 into 8Ω. Freq. range: 0Hz-100KHz ±3dB. THD: 0.1% or better. S/N ratio: 80dB. Sensitivity: 3mV into 47K. Power Requirement: ±24-40 Volts.



★ SPECIAL ★  
EXCELLENT PRICE!  
MODEL 001-0034  
\$29.50 Per Kit  
Transformer \$10.50 ea.

## TA-323 60 WATTS TOTAL 30W + 30W STEREO AMP KIT

This is a solid state all transistor circuitry with on board stereo pre-amp for most microphone or phone input. Power output employs 2 pairs matching Darlington Transistors driven by the popular 2N3053 Driver Transistors. Four built on board controls for, volume, balance, treble and bass. Power supply requires 48VCT 2.5A transformer. THD of less than 0.1% between 100Hz-10KHz at full power. (30 Watts + 30 Watts loaded into 8Ω).

## 1 WATT AUDIO AMP

All parts are pre-assembled on a mini PC Board. Supply Voltage 6-9VDC SPECIAL PRICE \$1.95

## 6W AUDIO AMP KIT

TBA810 with Volume Control. Power Supply 6-18VDC

Only \$7.50 ea.

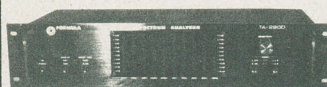
## AUDIO FREQUENCY SPECTRUM ANALYSER KIT TA-2900

This Audio Frequency Spectrum Analyser analyses audio signals in 10 octaves over a dynamic range of 30dB. The technique allows the sound coloration introduced by unwanted room and speaker resonances to be substantially eliminated.

The TA-2900 provides a visual presentation of the changing spectrum thru 100 red LED displays, so you can actually see proof of the equalized sound you've achieved. The TA-2900 kit comes with all the electronic components, IC's, predrilled PC board, the instructions and a 19" Rack Mount type metal cabinet with professional silk-screen printed front panel.

- Input Sensitivity Tape Monitor/10mV - 18mV 50K Ω
- Speaker Terminal/0.2W - 100W 8Ω
- Display Level Range (all octaves) 2dB per step/-14dB to -4dB.
- Delay Time (1KHz) Fast/18dB/s Slow/6dB/s
- Power Input 117V or 220V AC 50/60 Hz.
- Power Consumption 36W
- Dimensions 482(W) x 102(H) x 250(D) mm.

\$99.50 per kit



## TA-1000 KIT

\$51.95  
Power Transformer \$24.00 ea.



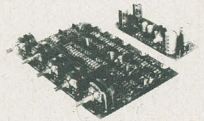
## 100W CLASS A POWER AMP KIT

Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low TIM stereo pre-amp. Specifications: • Output power 100W RMS into 8Ω. 125W RMS into 4Ω • Frequency response 10Hz-100KHz • THD less than 0.01% • S/N ratio better than 80dB • Input sensitivity 1V max. • Power supply ±40V @ 5A.

## LOW TIM DC STEREO PRE-AMP KIT TA-1020

Incorporates brand-new DC design that gives a frequency response from 0-100KHz ±0.5dB. Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuation! Specifications: • THD/TIM less than .005% • Frequency response DC to 100KHz ±0.5dB • RIAA deviation ±0.2dB • S/N ratio better than 70dB • Sensitivity Phono 2mV 47K/Aux 100mV 100K • Output level 1.3V • Max output 15V • Tone controls Bass ±10dB @ 50Hz/Treble ±10dB @ 15KHz • Power supply ±24VDC @ 0.5A. Kit comes with regulated power supply, all you need is a 48VCT transformer @ 0.5A.

Only \$44.50  
X'former \$4.50 ea.



## "FISHER" 30 WATT STEREO AMP

MAIN AMP (15W x 2). Kit includes 2 pcs. Fisher PA 301 Hybrid IC, all electronic parts with PC Board. Power supply ±16VDC (not included). Power band with KF 1% ±3dB. Voltage gain 33dB. 20Hz-20KHz.

Super Buy

Only \$18.50

## ULTRASONIC SWITCH KIT

Kit includes the Ultra Sonic Transducers, 2 PC Boards for transmitter and receiver, all electronic parts and instructions. Easy to build and a lot of uses such as remote control for TV, garage door, alarm system or counter. Unit operates by 9-12VDC.

\$15.50 ea.



PRESS-A-LIGHT  
SELF GENERATED  
FLASHLIGHT

Never worry about battery, because it has none! Easy to carry in pocket and handy to use. Ideal for emergency light. It generates its own electricity by squeezing grip lever. Put one in your car, boat, camper or home. You may need it some time!

EXCLUSIVE \$3.95 ea.

SHIPPING AND HANDLING CHARGES  
Under \$50.00 Purchase Over \$50.00 Purchase  
10% 5%  
15% 10%  
25% 20%

## STORE HOURS

MON. - FRI. 10-7  
SAT. 10-6

Minimum Order \$10.00/Calif. Residents add 6.5% Sales Tax. Phone Orders Accepted on VISA or MC ONLY. NO C.O.D.'s. Prices Subject to Change Without Notice

Inside California  
Outside Calif. (Incl. Mexico & Canada)  
Overseas



# FORMULA INTERNATIONAL INC.

12603 CRENSHAW BOULEVARD • HAWTHORNE, CALIFORNIA 90250 • (213) 973-1921

## Experience the Pineapple Computer System



### THE Pineapple™

#### 48K Color Computer Kit

##### Features:

- ★ 6502 MPU
- ★ Color graphics
- ★ Numeric key pad
- ★ Game paddle jacks on both sides
- ★ Speaker volume control on the back
- ★ Expansion slots

**\$645<sup>00</sup>**  
per kit

Easy to assemble! All components are clearly silk screened on the circuit board. Kit includes pre-drilled double sided PC Board, all integrated circuits, sockets, professional high-impact plastic casing, keyboards, connectors and switching power supply. Dealer inquiries invited. No C.O.D. orders

### 5 1/4" Flexible Disc Sale

Why buy other brands when you can buy WABASH discs for much less and backed by 1 year factory warranty.

All discs come with Hub Rings

PART #	DESCRIPTION	PRICE			
		10-99	100-499	500-999	1 K Up
M13A411X	5 1/4" SSDD Soft Sector	\$2.25	\$2.15	\$2.05	\$1.90
M43A411X	5 1/2" SSDD 10 Hard Sector	\$2.25	\$2.15	\$2.05	\$1.90
M53A411X	5 1/4" SSDD 16 Hard Sector	\$2.25	\$2.15	\$2.05	\$1.90
M14A411X	5 1/4" DSDD Soft Sector	\$3.65	\$3.45	\$3.15	\$2.90
F111111X	8" SSDD IBM compatible	\$2.45	\$2.25	\$2.15	\$2.00
F131211X	8" SSDD 26 sectors 128 bytes	\$3.05	\$2.80	\$2.60	\$2.50



**FOR INFORMATION  
CALL (213) 973-1921**

**OUTSIDE CALIFORNIA  
PHONE ORDERS ONLY**

**CALL TOLL FREE  
1-800-672-8758**

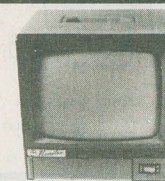
#### SAVE MORE ON OUR BULK 5 1/4" DISC!

We are not allowed to use the name of the manufacturer. Who cares! Our goal is to save you money! You know who they are if you saw our ad the last few times.

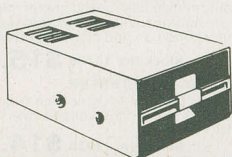
FACTORY PACKED, 100 DISCS PER BOX for just **\$1.85** ea. COMES WITH HUB RING AND WRITE PROTECT.

#### SPECIAL SALE ON LE MONITORS (Sanyo Look Alike)

9" Black and White.....	\$ 99.50
9" Green.....	\$120.00
12" Black and White.....	\$119.50
12" Green.....	\$139.50



#### SAVE ON OUR 5 1/4" DISC DRIVE



- ★ 100% Apple® Compatible!
- Much more quiet than the Shugart Drives.

**\$310.00** Each

**\$399.00** Each (with controller)

#### 16K RAM CARD KIT FOR YOUR APPLE® COMPUTER

Kit includes: High Quality P.C. Board • 8 ea. 4116 (200ns) • All the IC's & parts • 16-pin Dip wire • Easy to assemble. You can do it in less than 30 minutes!

**\$59.95** per kit  
(Limited Quantity)

\* Apple is a registered trademark of APPLE COMPUTERS, INC.

##### SHIPPING AND HANDLING CHARGES

	Under \$50.00 Purchase	Over \$50.00 Purchase
Inside California	10%	5%
Outside Calif. (Incl. Mexico & Canada)	15%	10%
Overseas	25%	20%

Minimum Order \$10.00 / Calif. Residents add 6.5% Sales Tax. Phone Orders Accepted on VISA or MC ONLY, NO C.O.D.'s. Prices subject to change without notice.



**STORE HOURS**  
**MON-FRI — 10-7**  
**SAT — 10-6**

**CIRCLE 45 ON FREE INFORMATION CARD**



### TUSA

A WHOLE NEW WORLD OF TV VIEWING WITH TUSA'S NEW MODEL CUV-40 CHANNEL CABLE TV CONVERTER. Receive all the EXTRA CABLE TV "MIDBAND" & SUPERBAND CHANNELS on your UHF DIAL.

Eliminates the need for renting or leasing. This stable and reliable system converts extra cable TV channels so they can be received on the UHF tuner of your TV set. Provides the extra midband and superbond channels now distributed by most cable companies. Channels 2 to 13 can also be seen directly on the VHF portion of your tuner.

**A MUST FOR VIDEO-TAPING FROM CABLE TV!**

The system allows you to program both pay (pay TV decoder required) and standard cable channels for taping on any VCR — while you are watching a different channel on your TV.

Simple to install and operate on any make of TV with UHF.

**Now \$28.95 ea.**  
PLUS POSTAGE

**WINEGARD**  
75 OHM UHF YAGI ANTENNAS

12 db GAIN  
CHANNELS 44-52  
\$8.95 ea.  
6 OR MORE \$6.95 ea.  
\$39.95 ea.

**BRAND NEW UHF VARIATOR TUNERS**

Sanyo 45 MHz Output \$24.95 ea.  
Mitsumi 45 MHz Output \$24.95 ea.  
Call for Quantity Prices

**SURPLUS SYLVANIA VHF VARIATOR TUNERS**

45 MHz Output. Channels 2 through 13 as well as the mid-band channels. Schematic included.

**WHILE THEY LAST! \$13.95 ea.**

### POPULAR IC's

TYPE	DESCRIPTION	1-9	10-UP
LM-380N	2 watt Audio Power Amp	\$1.49	\$1.29
LM-380N-3	Low Voltage Audio Amp	1.59	1.29
NE-561	Phase Locked Loop	12.95	11.95
NE-564N	Digital Phase Locked Loop	3.50	3.15
LM-565N	Phase Locked Loop	1.49	1.29
LM-733N	Video Amp	1.69	1.44
MC-1330	Video Detector	2.49	1.89
MC-1349	Video IF Amp	2.06	1.85
MC-1350	Video IF Amp	1.75	1.55
MC-1352	Video IF Amp AGC	2.69	2.09
MC-1358	Audio IF Amp	1.95	1.79
MC-1374P	R.F. Modulator	3.19	2.87
MC-1458	Dual Comp. Op. Amp	.89	.79
MC-1496N	Balanced Mod/Demodulator	1.79	1.59
LM-1800	PLL Stereo Decoder	4.49	3.95
LM-1809	Video Modulator	2.95	2.49
LM-7805	5 Volt Positive Volt. Reg.	1.39	1.25
LM-7808	8 Volt Positive Volt. Reg.	1.39	1.25
LM-7812	12 Volt Positive Volt. Reg.	1.39	1.25
LM-7815	15 Volt Positive Volt. Reg.	1.39	1.25
LM-7818	18 Volt Positive Volt. Reg.	1.39	1.25
LM-7824	24 Volt Positive Volt. Reg.	1.39	1.25

**Radial Lead Caps**  
10 mfd@35V . . . 1-11 \$2.25 ea.  
12 or more . . . 1.60 ea.  
1 mfd@35V . . . 1-11 \$2.25 ea.  
12 or more . . . 1.60 ea.  
470 mfd@35V . . . 1-11 \$2.25 ea.  
12 or more . . . 1.60 ea.  
1000 mfd@35V . . . 1-11 \$2.25 ea.  
12 or more . . . 1.60 ea.  
2200 mfd@35V . . . 1-11 \$2.25 ea.  
12 or more . . . 1.60 ea.  
1000 mfd@50V . . . 1-11 \$3.95 ea.  
12 or more . . . 2.79 ea.  
2200 mfd@50V . . . 1-11 \$3.95 ea.  
12 or more . . . 2.79 ea.  
3300 mfd@50V . . . 1-11 \$3.95 ea.  
12 or more . . . 2.79 ea.

**Axial Lead Caps**  
1000 mfd@50V . . . 1-11 \$3.95 ea.  
12 or more . . . 2.79 ea.  
2200 mfd@50V . . . 1-11 \$3.95 ea.  
12 or more . . . 2.79 ea.  
3300 mfd@50V . . . 1-11 \$3.95 ea.  
12 or more . . . 2.79 ea.

**5% MICA CAPS 5%**  
10pf .42c ea. 500pf .65c ea.  
43pf .36c ea. 1200pf .89c ea.  
110pf .36c ea. 3000pf 1.39c ea.  
Call for Quantity Discount

**POPULAR MICROWAVE PARTS**  
MRF-901 . . . \$2.75  
9-up . . . 2.19  
MRF-911 . . . 3.46  
9-up . . . 3.12  
MBD-101 . . . .98  
CHIP CAPS .001 mfd . . . 50  
26-Up . . . 30  
2N6803 (formerly MRF-902) . . . 11.96

**PROJECT BOXES**  
Woodgrain

This box is 11 1/4" W - 4 1/2" H - 6 1/2" D with a removable aluminum U-shaped chassis.  
11" W - 3 1/2" H - 6" D inside.

**\$12.50 ea.**  
4 or more \$10.95 ea.

**UHF - VHF - FM SPLITTER**  
40-900 MHz

Low Loss 3.5 db, Low VSWR  
Waterproof

**\$2.49 ea.**

**POPULAR MISCELLANEOUS PARTS**  
10K Volume Control with DPDT switch . . . \$1.49  
10-Up . . . 1.31  
Low Loss UHF/VHF/FM 75-300 ohm Matching Transformer . . . 1.29  
10-Up . . . .98  
Toroids - T30-12 . . . .46  
20-Up . . . .25  
Toroids - T37-2 . . . .38  
20-Up . . . .25

**WINEGARD DELUXE A-B SWITCH**  
For CATV - MATV - VCR  
75 ohm - 90 db isolation  
While They Last \$6.95 ea.

**ORDER NOW TOLL FREE 800-854-4655**  
OUTSIDE CALIFORNIA 714-635-5090  
INSIDE CALIFORNIA 714-635-5090

**R.F. ELECTRONICS**  
1056 N. STATE COLLEGE BLVD., DEPT. R  
ANAHEIM, CALIFORNIA 92806

**PERSONAL CHECKS HELD FOR CLEARANCE**  
MAIL ORDERS WELCOME — PLEASE INCLUDE POSTAGE — SHIPPED SAME DAY RECEIVED — NO MINIMUM ORDER

### Kaise Autorangeing DIGITAL MULTIMETERS

The state-of-the-art autorangeing DMM — with high accuracy and convenient features for today's electric/electronic professionals.

SK-1440

SK-1330

Model SK-1440:

- 3.5-digit LCD with auto unit and sign indications
- Full autorangeing on Volt and Ohm with 10A AC/DC range
- Input value can be put into memory to make difference measurements like a galvanometer
- Autorangeing Voltage Test: 200mV-1000V DC, 2V-600V AC
- AC/DC Current Tests: 200mA-10A
- Resistance Tests: 200Ω-2000KΩ
- Autorangeing Low Power Ohm Tests: 2KΩ-2000KΩ
- DC Volt Accuracy: ±0.8% reading, ±0.2% full scale
- Low Battery Consumption: 300 hrs. on two AA batteries (included)
- Test leads with protective rim prevents fingers from touching probe
- Submerged connectors for added safety
- Folding test stand for easy viewing
- Dual fuse for safety protection

**SK-1440 \$99.50**

Model SK-1330: All the above plus these additional features:

- DC Volt Accuracy: ±0.5% reading, ±0.2% of full scale
- Built-in Beeper (switchable) for continuity tests, overload warning
- Extended AC/DC current range: 20mA-10A
- Manually overrides the autorangeing function so that the desired range can be selected for voltage and resistance measurements
- Zero Adjust function cancels the resistance value of test leads for the easiest and most accurate measurements

**SK-1330 \$159.50**

### 5" TANDON DRIVES

Brand new IBM compatible internal drives. Fully supported by the new PC DOS 3.11. Our exclusive step-by-step instruction makes installation easy.

TM-100-1 Single sided (160 KB) . . . \$207.99  
TM-100-2 Double sided (320 KB) . . . \$289.99

### \*\*\*\*\* PRINTERS SALE \*\*\*\*\*

Epson MX80FT w/Graphtrax-Plus, 80 CPS, . . . \$645 \$520.00  
Epson MX100 w/Graphtrax-Plus, 100 CPS, 136 Col. . . \$895 \$643.99  
C. Itoh Prowriter 8510 AP 120 CPS, Parallel . . . \$795 \$467.99  
C. Itoh F-10 Daisywheel, 40 CPS, Parallel . . . \$2,995 \$1,993.99  
C. Itoh F-10 Daisywheel, 55 CPS, Parallel . . . \$2,295 \$1,644.99

To order, send money order or cashier's check. Personal checks cleared 4 weeks. Visa/Mastercard welcome. Add 1% (Min. \$3) of total order value for shipping & handling by UPS truck. Add 4% of order value for shipment by Air UPS or Parcel Post. California residents please add sales tax. COD's requires 20% deposit.

### EASTERN ENTERPRISES, INC.

2937 S. VAIL, COMMERCE, CA 90040 • (213) 725-3080

**CIRCLE 77 ON FREE INFORMATION CARD**

**CIRCLE 85 ON FREE INFORMATION CARD**

### ARES ZERO INERTION FORCE SOCKETS

cam actuated, true zero insertion — tin plated solder tail pins — capable of being plugged into dip sockets, including wire wrap.

Stock No.	No. Pins	1-24	25-50
11055	24	\$ 4.35	\$ 3.90
11056	28	\$ 4.50	\$ 4.05
11057	40	\$ 5.95	\$ 5.45
11058	64	\$ 10.50	\$ 9.45

Stock No. 1-19 10 25  
12098 \$ 1.28 \$ 1.12 \$ .95

### RESISTOR ASSORTMENT

82508 - 700 pcs. (1 each below assort'd.) **\$22.50**

Stock No. 82501 10 ea. of 10-12-15-18-22-27-33-39-47-56 OHM

Stock No. 83502 10 ea. of 68-82-100-120-150-180-220-270-330-390 OHM

Stock No. 82503 10 ea. of 470-560-680-820-1K-1.2K-1.5K-1.8K-2K-2.2K-2.7 OHM

Stock No. 82504 10 ea. of 3.3K-3.9K-4.7K-5.6K-6.8K-8.2K-10K-12K-15K-18K OHM

Stock No. 82505 10 ea. of 22K-27K-33K-39K-47K-56K-68K-82K-100K-120K OHM

Stock No. 82506 10 ea. of 150K-180K-220K-270K-330K-390K-470K-560K-680K-820K OHM

Stock No. 82507 10 ea. of 1M-1.2M-1.5M-1.8M-2.2M-2.7M-3.3M-3.9M-4.7M-5.6M OHM

### WILD ROVER

Touch switch capsule. Operating motion is .005" without the use of a levered arm. Extremely fast on and off with low noise. Normally open — rated 115 VAC, 1.5 amp-30 milliohm resistance — 615 radius by 160 thick.

Stock No. 1-19 10 25  
12098 \$ 1.28 \$ 1.12 \$ .95

### TI WIRE WRAP SOCKETS

Tin plated phosphor bronze contact - 3 wrap

Stock No.	No. Pins	1-24	25-100
11301	8	\$ 4.55	\$ 4.00
11302	14	.66	.59
11303	16	.72	.64
11304	18	.82	.73
11305	20	1.11	.99
11306	22	1.26	1.12
11307	24	1.41	1.25
11308	28	1.71	1.52
11309	40	2.31	2.05

### TI LOW PROFILE SOCKETS

Tin plated phosphor bronze contact - 1 pin with gas tight seal

Stock No.	No. Pins	1-24	25-100
11201	8	\$ 1.15	\$ 1.12
11202	14	.18	.15
11203	16	.21	.18
11204	18	.24	.21
11205	20	.27	.24
11206	22	.30	.26
11207	24	.33	.30
11208	28	.38	.34
11209	40	.53	.45

### ELPAC POWER SUPPLIES - DC/DC CONVERTERS

Stock No.	ELPAC Part No.	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Dimensions (HxWxD) in inches	Price
13825	CB3801	3-7.0	12.0-6	0-25	48x51x3.05	\$ 7.95
13826	CB3811	3-7.0	12.0-6	0-25	48x51x3.05	\$ 7.95
13827	CB3802	3-7.0	15.0-7	0-20	48x51x3.05	\$ 7.95
13828	CB3812	3-7.0	15.0-7	0-20	48x51x3.05	\$ 7.95
13829	CB3804	3-7.0	28.0-7	0-10	48x51x3.05	\$ 7.95
13830	CB3814	3-7.0	28.0-7	0-10	48x51x3.05	\$ 7.95

1.5 W TYPE:

Stock No.	ELPAC Part No.	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Dimensions (HxWxD) in inches	Price
13831	CL3801	4-0.7	12.0-6	125	65x11x2.1	\$24.95
13832	CL3811	4-0.7	12.0-6	125	65x11x2.1	\$24.95
13833	CL3802	4-0.7	15.0-7	100	65x11x2.1	\$24.95
13834	CL3812	4-0.7	15.0-7	100	65x11x2.1	\$24.95
13835	CL3804	4-0.7	28.1-4	50	65x11x2.1	\$24.95
13836	CL3814	4-0.7	28.1-4	50	65x11x2.1	\$24.95

13801-1 Data Sheet for 13801 \$ 25  
13802-1 DATA SHEET FOR DC/DC CONVERTERS 25

### ELPAC POWER SUPPLIES - SOLV SERIES FULLY REGULATED

Stock No.	ELPAC Part No.	Output Voltage	Output Current	Dimensions (HxWxD) in inches	OVP	Price
13802	SOLV15-5	5	3.0A	4.7/16x4.2	Fixed included	\$39.95
13803	SOLV15-12	12	1.5A	4.7/16x4.2	Fixed included	\$39.95
13804	SOLV15-15	15	1.2A	4.7/16x4.2	Fixed included	\$39.95
13806	SOLV15-24	24	0.75A	4.7/16x4.2	Fixed included	\$39.95
13808	SOLV30-5	5	6.0A	5.5/8x4.7/8x3.3/16	DVP-4	\$59.95
13809	SOLV30-12	12	4.0A	5.5/8x4.7/8x3.3/16	DVP-4	\$59.95
13810	SOLV30-15	15	3.3A	5.5/8x4.7/8x3.3/16	DVP-4	\$59.95
13812	SOLV30-24	24	2.0A	5.5/8x4.7/8x3.3/16	DVP-4	\$59.95

13802-1 Data Sheet for SOLV Series 25

### OK MACHINE AND TOOL

#### IC INSERTION/EXTRACTION KIT

Includes DIP IC extractors and inserters to accommodate all ICs from 14 to 40 pins. Tools that engage conductive surfaces are CMOS safe and include grounding lugs. Stock No. \$37.74 13309

#### SOCKET WRAP ID

DIP socket-sized plastic panels with numbered holes in pin locations. Slip onto socket before wire wrapping to identify pins. Also write on them for location, IC part number, function, etc. Simplifies shooting and repair.

Stock No.	Length Weight	Price
50075	062 9 1.5	\$1.16
50076	062 25 4	\$2.39
50077	062 50 8	\$4.25
50078	032 33 1.5	\$1.31
50079	032 88 5	\$4.27
50080	032 175 8	\$4.57

**\$1.82 per pack of 10**

#### IC EXTRACTOR

One-piece, spring steel construction. Will extract all LSI, MSI and SSI devices with 8 to 24 pins. Stock No. 13313 **\$2.10**

### Special of the Month!

#### MEMORY SALE!

4116-3 200NS 16K Dynamic Ram **\$2.10 ea.**  
Stock No. 47650 **8/\$15.52**

2114-L-3 300NS 4K Static Ram **\$2.45 ea.**  
Stock No. 47640 **8/\$17.84**

2716 450NS 16K Eprom **\$3.90 ea.**  
Stock No. 47632 **Any Quantity!**

#### PIN FORMING TOOL

puts IC's on their true row to row spacing. One side is for 300 centers, Flip tool over for devices on 600 centers. Put device in tool and squeeze.

**ONE TOOL DOES 8 Thru 40 PINS!**  
Stock No. 11059 **\$12.95**

#### MODUTECH

##### Miniclamp AC Volt-Ammeter

allows singling one conductor out of many without disarrangement.

Stock No.	AC Amperes	Price
13730	0-25A	\$39.50
13731	0-50A	\$39.50
13732	0-100A	\$39.50

**ACCESSORY LINE SPLITTER**  
allows fast readings of AC power consumption of plug in equipment without separation of leads.  
Stock No. 13727 **\$9.95**

##### POCKET SIZED BATTERY TESTER

for all types of small batteries from 1.35v to 4.5v  
Stock No. 13733 **\$13.95**

##### VOLT-ICATOR

automotive diagnostic meter plugs into lighter socket and indicates battery condition and charging rates.  
Stock No. 13736 **\$15.95**

##### AC VOLTAGE TESTER

plugs into any 110v service receptacle to check time voltage over 50-150 VAC  
Stock No. 13735 **\$14.95**

##### VOM-MULTITESTER

versatile Volt-Ohm-Milliammeter in small package  
Stock No. 13729 **\$13.95**



(602) 266-9758 (602) 234-3026



6835 N. 16th Street • Phoenix, AZ 85016

## SPECIAL \$1.00 SPECIAL

1N4152... 25/1.00 Similar to 1N914	1N5239... 20/1.00 9 V. ZENER
1N4001... 15/1.00	1N4007... 10/1.00
TIP 3055... 3/1.00	2N3055... 3/1.00
MJ 3000... 1.00 Pwr Darlingtong TO3	2N6055... 1.00 Pwr Darlingtong TO3
TRIAC 200 V. 30A. Stud mnt.... 1.00	7 Seg. LED Readout HP 5082-7650 5/1.00
4 Pos DIP switch 3/1.00	DIP Relay D.P.S.T. Diode Protect. 5/1.00
D.P.D.T. Rocker Sw 4 A. 120 VAC 3/1.00	Horz P.C. Trimpots 250Ω, 500Ω, 5kΩ, 10kΩ ..... 4/1.00
2N2142	MC3420P... 1.00
2N3905 5/1.00	SN75150... 1.00
2SC828	LM3909... 1.00
2SC644	RED LED... 8/1.00
SPS7390/ECG123P	Transformer... 1.00
5 V. DIP Relay	12 V.C.T. 250 MA
SPST ..... 2/1.00	TO39 Heat Sinks 3/1.00
7805	
7812..... 2/1.00	
MINI D.P.D.T. Slide ..... 4/1.00	

## POWER SUPPLY SPECIAL



110/220 volts

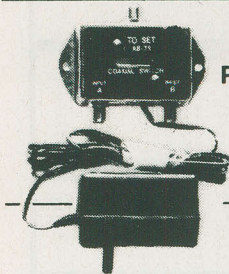
\$34<sup>95</sup>

14 lbs.

+35 V.-.5 A/+12-1 A/+5 V.-.6 A  
+26 V.-.75 A/-12-.5 A/-5 V.-.75 A

Transformer 110 V.A.C. Input  
2 1/2 V. @ 1 A out P.C. Mount ..... **\$295**

5 to 25 PF Trim Cap ..... 12/2.50



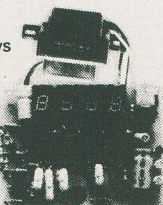
**DOWN  
CONVERTER  
POWER SUPPLY**  
8-12 V.D.C. or  
12-18 V.D.C.

**\$14<sup>95</sup>**

**DIGITAL  
MULTI-METER  
ASSEMBLY**

Includes:  
(4) 7 seg. LED displays  
(1) ICL 7107 (A-D IC)  
(1) +5 V. Reg.  
(1) -5 V. Reg.  
(1) Bridge  
(1) Pwr. Trans.  
Resistors & caps

**\$14<sup>95</sup>**



**ALL ORDERS PLUS POSTAGE VIA UPS**



(602) 266-9758  
(602) 234-3026



CIRCLE 74 ON FREE INFORMATION CARD

## QUALITY parts at DISCOUNT PRICES

### MINI BSR



\$17.50 each

### AUTOMATIC RECORD CHANGER

\* B.S.R. MODEL C136R/C/3  
\* PLAYS 33/45/78 RECORDS  
\* MINI SIZE: 8 1/4" X 12"

INCLUDES DUST COVER AND  
PLASTIC CASE (NOT PICTURED)  
WITH FRONT CUT OUT TO FIT  
STEREO UNIT (NOT INCLUDED).

### JOYSTICK



PRECISION  
DEVICE...  
CONTAINS 4  
50K CENTER  
TAPPED ALPS  
POTS. \$4.75 ea

### VARACTOR DIODES

BB-103 3 FOR \$1.00  
100 FOR \$30.00  
MV2205 3 FOR \$1.00  
100 FOR \$30.00

### MITSUMI MODEL UES-A55 VARACTOR UHF TUNER



FREQ. RANGE  
470 - 889 MHz  
ANTENNA INPUT  
300 OHMS  
\$25.00 each  
10 for \$220.00

### SLIDE POTS

500K  
linear taper  
2 7/8" LG. 75¢ EACH  
1 3/4" TRAVEL 75¢ EACH

### BLACK PLASTIC CASE



PAC-TEC  
SERIES C  
BLACK PLASTIC ENCLOSURE  
ADJUSTABLE HEIGHT FROM  
1.63" TO 2.93". WIDTH  
6.85". DEPTH 8". BUILT-  
IN STAND OFFS FOR P.C.  
BOARDS. FRONT AND BACK  
PANELS NOT INCLUDED..  
\$5.25 PER CASE

### 35 MFD 330 VOLT

1 1/2" X 5/8" DIA.  
45¢ EACH... 10 FOR \$4.00

### 170 MFD 330 VOLT

1 1/2" X 7/8"

2 FOR \$1.50/10 FOR \$7.00

### 600 MFD 360 VOLT

3 3/4" HIGH X 1" DIA.  
\$1.00 EA. 10 FOR \$9.00

### 750 MFD 330 VOLT

2" HIGH X 1 3/4"

\$1.25 EACH 10 FOR \$11.00

### COMPUTER GRADE CAPACITOR

1700 mfd. 150VDC \$2.00

2 1/2" DIA X 4 3/4" HIGH

3,600 mfd. \$1.00

40VDC 1 3/8" DIA. X 3" HI

6,400 mfd. 60VDC \$2.50

1 3/8" DIA X 4 1/4"

12,000 mfd. 40VDC \$3.00

2" DIA X 4 1/2" HIGH

18,000 mfd. 75 VDC \$4.00

2 1/2" DIA X 4 1/2" HIGH

22,000 mfd. 15VDC

2 1/2" DIA X 2 1/2" HIGH \$2.00

22,000 mfd. 40VDC

2 1/2" DIA. X 6" HIGH \$3.00

24,000 mfd. 30 VDC

1 5/8" DIA X 4" HI \$3.50

31,000 mfd. 15VDC

1 5/8" DIA X 4" HI \$2.50

72,000 mfd. 15VDC

2" DIA. X 4" HIGH \$3.50

### COMPUTER GRADE CAPACITOR SPECIAL

180,000 mfd. at 6V

2 1/2" DIA X 4 1/2" HIGH \$1.50

CLAMPS TO FIT CAPACITORS 50¢ ea.

### DC WALL TRANSFORMER

ALL ARE 115VAC

PLUG IN

4 VDC at 70 MA \$2.50

5.8 VDC at 125 MA \$2.50

9 VDC at 100 MA \$2.00

9 VDC at 225 MA \$3.00

22 VDC at 60 MA \$2.50

### TRANSFORMERS

120 volt

primaries

5.6 VOLTS at 750 MA \$3.00

6 VOLTS at 150 MA \$1.25

16.5 V. at 3 AMPS \$6.50

18 VOLTS at 350 MA \$2.00

18 VOLTS at 1 AMP \$4.50

18 V.C.T. at 2 AMP \$5.50

24 VOLTS at 250 ma \$2.50

28 VCT. at 3.8 AMP \$6.50

35 VCT. at 1 AMP \$3.50

42 V.C.T. at 1.2 AMP \$4.50

65 V.C.T. at 2 AMP \$5.50

### L.E.D.'s

STANDARD JUMBO

DIFFUSED

RED 10 FOR \$1.50

GREEN 10 FOR \$2.00

YELLOW 10 FOR \$2.00

FLASHER LED

5 VOLT OPERATION

RED JUMBO SIZE

\$1.00 EACH

BI POLAR LED

2 FOR \$1.70

SUB MINI LED

RED

.079" X .098" 10 FOR

20ma at 1.75v \$1.00

200 FOR \$18.00

LED HOLDERS

TWO PIECE HOLDER

FOR JUMBO LED

10 FOR 65¢ 200 FOR \$10.00

8' LINE CORD

SUT M/E

18 - 3

ROUND GRAY

\$2.00 EACH

10 FOR \$18.50

**FREE! SEND FOR OUR NEW 1983 40 PAGE CATALOG FREE!**

### KEYBOARD w/ case



16 KEY  
KEYBOARD  
MATRIX  
ENCODER

TERMINATES TO FLEXIBLE  
CABLE WITH CONTACTS ON  
100 CENTERS. EDGE  
CONNECTOR INCLUDED...

\$4.50 PER KEYBOARD, CASE,  
AND CONNECTOR.....

EDGE CONNECTOR

ALL ARE .156" SPACING

15/30 GOLD

SOLDER EYELET \$2.00 EACH

18/36 GOLD

SOLDER EYELET \$2.00 EACH

22/44 GOLD

SOLDERTAIL (P.C. STYLE)

\$2.50 EA 10 FOR \$22.50

22/44 TIN

SOLDERTAIL (P.C. STYLE)

\$1.35 EA 10 FOR \$12.50

22/44 GOLD

SOLDER EYELET \$2.50 EACH

6volt 9amp/hr

RECHARGEABLE

ELPOWER # EP690

SOLID GEL CELL

5 1/2" X 4 1/4"

X 2 3/4".....

\$15.00 EACH

BLACK LIGHT  
(ULTRAVIOLET)

G.E. # F6T5BL \$2.50 each

EQUIPMENT SLIDES

CHASSIS-TRAK MODEL

C3005

HOLDS TO 85 LBS, EXTENDS 23"

\$5.00 PER PAIR SOME HARDWARE INCLUDED

CRYSTALS

CASE STYLE HC33/U

2 MHZ: 3579,545 KC

\$3.50 EACH \$1.00 EACH

TOLL FREE ORDERS ONLY

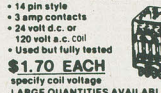
1-800-826-5432

(ORDER ONLY)

ALASKA, HAWAII, CALIF

OR INFORMATION (213) 380-8000

### 4PDT RELAY



14 pin style  
3 amp contacts  
24 volt d.c. or  
120 volt a.c. coil  
Used but fully tested  
\$1.70 EACH  
specify coil voltage  
LARGE QUANTITIES AVAILABLE  
SOCKETS FOR RELAY 50¢ each

### 6 VDC RELAY

MINIATURE

D.P.D.T.

3 AMP CONTACTS

FUJITSU # FBR321D006

\$1.75 EA 10 / 16.00

### 2 CHANNEL LIGHT ORGAN

EASILY HOOKS INTO STEREO SPEAKERS

AND ALLOWS 110 VAC LIGHTS TO DANCE

WITH MUSIC. TWO SEPARATE 110 VAC

OUTPUTS FOR HIGH AND LOW FREQUENCY

AUDIO SIGNALS. USE TWO ORGANS FOR

STEREO... \$6.50 PER UNIT

COLOR LIGHT STRING AVAILABLE \$1.75 EA

### FOOT CONTROL WITH SIDE SWITCH

MEASURES 4 3/4" X 9 3/4"

WITH 100 K LINEAR POT AND

MOMENTARY S.P.D.T. SWITCH.

\$6.50 EACH

### CANNON XLRA-3-13 CONNECTOR

3 PRONG

CHASSIS MOUNT

CONNECTOR

\$2.00 EACH

10 for \$19.00

### CRYSTALS

CASE STYLE HC33/U

2 MHZ: 3579,545 KC

\$3.50 EACH \$1.00 EACH

### 4 CHANNEL 8 TRACK HOME UNIT

BRAND NEW UNITS...

ASSEMBLY INCLUDES:

TAPE HEAD, MOTOR BELT,

110VAC MOTOR, PRE-AMP,

LIGHTS, SWITCHES,

SOLENOID AND OTHER

USEFUL PARTS....

AN EXCEPTIONAL BUY!

\$7.25 PER ASSEMBLY

### METAL OXIDE VARISTOR

G.E. # V82ZA12

82 VOLTS, NOMINAL

D.C. VOLTAGE, 5/8" DIAMETER. 2 FOR \$1.50

**ALL ELECTRONICS CORP.**  
**ALL ELECTRONICS CORP.**

905 S VERMONT AVE P O BOX 20406 LOS ANGELES, CA 90006

CIRCLE 58 ON FREE INFORMATION CARD







# CORPORATION

**NATIONAL SEMICONDUCTOR • PANASONIC • QUALITY** - Name brand products from nationally recognized manufacturers. **SERVICE** - Computerized order processing and inventory control. **SAVINGS** - Volume Discounts • OEM Quantity Pricing • Toll Free 800 Number

## INTEGRATED CIRCUITS

7400 TTL	74LS00 TTL	74500 TTL	4000 CMOS	Linear	Linear
7400N	74LS00N	74500N	4000N	LM741N	LM741N
7401N	74LS01N	74501N	4001N	LM742N	LM742N
7402N	74LS02N	74502N	4002N	LM743N	LM743N
7403N	74LS03N	74503N	4003N	LM744N	LM744N
7404N	74LS04N	74504N	4004N	LM745N	LM745N
7405N	74LS05N	74505N	4005N	LM746N	LM746N
7406N	74LS06N	74506N	4006N	LM747N	LM747N
7407N	74LS07N	74507N	4007N	LM748N	LM748N
7408N	74LS08N	74508N	4008N	LM749N	LM749N
7409N	74LS09N	74509N	4009N	LM750N	LM750N
7410N	74LS10N	74510N	4010N	LM751N	LM751N
7411N	74LS11N	74511N	4011N	LM752N	LM752N
7412N	74LS12N	74512N	4012N	LM753N	LM753N
7413N	74LS13N	74513N	4013N	LM754N	LM754N
7414N	74LS14N	74514N	4014N	LM755N	LM755N
7415N	74LS15N	74515N	4015N	LM756N	LM756N
7416N	74LS16N	74516N	4016N	LM757N	LM757N
7417N	74LS17N	74517N	4017N	LM758N	LM758N
7418N	74LS18N	74518N	4018N	LM759N	LM759N
7419N	74LS19N	74519N	4019N	LM760N	LM760N
7420N	74LS20N	74520N	4020N	LM761N	LM761N
7421N	74LS21N	74521N	4021N	LM762N	LM762N
7422N	74LS22N	74522N	4022N	LM763N	LM763N
7423N	74LS23N	74523N	4023N	LM764N	LM764N
7424N	74LS24N	74524N	4024N	LM765N	LM765N
7425N	74LS25N	74525N	4025N	LM766N	LM766N
7426N	74LS26N	74526N	4026N	LM767N	LM767N
7427N	74LS27N	74527N	4027N	LM768N	LM768N
7428N	74LS28N	74528N	4028N	LM769N	LM769N
7429N	74LS29N	74529N	4029N	LM770N	LM770N
7430N	74LS30N	74530N	4030N	LM771N	LM771N
7431N	74LS31N	74531N	4031N	LM772N	LM772N
7432N	74LS32N	74532N	4032N	LM773N	LM773N
7433N	74LS33N	74533N	4033N	LM774N	LM774N
7434N	74LS34N	74534N	4034N	LM775N	LM775N
7435N	74LS35N	74535N	4035N	LM776N	LM776N
7436N	74LS36N	74536N	4036N	LM777N	LM777N
7437N	74LS37N	74537N	4037N	LM778N	LM778N
7438N	74LS38N	74538N	4038N	LM779N	LM779N
7439N	74LS39N	74539N	4039N	LM780N	LM780N
7440N	74LS40N	74540N	4040N	LM781N	LM781N
7441N	74LS41N	74541N	4041N	LM782N	LM782N
7442N	74LS42N	74542N	4042N	LM783N	LM783N
7443N	74LS43N	74543N	4043N	LM784N	LM784N
7444N	74LS44N	74544N	4044N	LM785N	LM785N
7445N	74LS45N	74545N	4045N	LM786N	LM786N
7446N	74LS46N	74546N	4046N	LM787N	LM787N
7447N	74LS47N	74547N	4047N	LM788N	LM788N
7448N	74LS48N	74548N	4048N	LM789N	LM789N
7449N	74LS49N	74549N	4049N	LM790N	LM790N
7450N	74LS50N	74550N	4050N	LM791N	LM791N
7451N	74LS51N	74551N	4051N	LM792N	LM792N
7452N	74LS52N	74552N	4052N	LM793N	LM793N
7453N	74LS53N	74553N	4053N	LM794N	LM794N
7454N	74LS54N	74554N	4054N	LM795N	LM795N
7455N	74LS55N	74555N	4055N	LM796N	LM796N
7456N	74LS56N	74556N	4056N	LM797N	LM797N
7457N	74LS57N	74557N	4057N	LM798N	LM798N
7458N	74LS58N	74558N	4058N	LM799N	LM799N
7459N	74LS59N	74559N	4059N	LM800N	LM800N
7460N	74LS60N	74560N	4060N	LM801N	LM801N
7461N	74LS61N	74561N	4061N	LM802N	LM802N
7462N	74LS62N	74562N	4062N	LM803N	LM803N
7463N	74LS63N	74563N	4063N	LM804N	LM804N
7464N	74LS64N	74564N	4064N	LM805N	LM805N
7465N	74LS65N	74565N	4065N	LM806N	LM806N
7466N	74LS66N	74566N	4066N	LM807N	LM807N
7467N	74LS67N	74567N	4067N	LM808N	LM808N
7468N	74LS68N	74568N	4068N	LM809N	LM809N
7469N	74LS69N	74569N	4069N	LM810N	LM810N
7470N	74LS70N	74570N	4070N	LM811N	LM811N
7471N	74LS71N	74571N	4071N	LM812N	LM812N
7472N	74LS72N	74572N	4072N	LM813N	LM813N
7473N	74LS73N	74573N	4073N	LM814N	LM814N
7474N	74LS74N	74574N	4074N	LM815N	LM815N
7475N	74LS75N	74575N	4075N	LM816N	LM816N
7476N	74LS76N	74576N	4076N	LM817N	LM817N
7477N	74LS77N	74577N	4077N	LM818N	LM818N
7478N	74LS78N	74578N	4078N	LM819N	LM819N
7479N	74LS79N	74579N	4079N	LM820N	LM820N
7480N	74LS80N	74580N	4080N	LM821N	LM821N
7481N	74LS81N	74581N	4081N	LM822N	LM822N
7482N	74LS82N	74582N	4082N	LM823N	LM823N
7483N	74LS83N	74583N	4083N	LM824N	LM824N
7484N	74LS84N	74584N	4084N	LM825N	LM825N
7485N	74LS85N	74585N	4085N	LM826N	LM826N
7486N	74LS86N	74586N	4086N	LM827N	LM827N
7487N	74LS87N	74587N	4087N	LM828N	LM828N
7488N	74LS88N	74588N	4088N	LM829N	LM829N
7489N	74LS89N	74589N	4089N	LM830N	LM830N
7490N	74LS90N	74590N	4090N	LM831N	LM831N
7491N	74LS91N	74591N	4091N	LM832N	LM832N
7492N	74LS92N	74592N	4092N	LM833N	LM833N
7493N	74LS93N	74593N	4093N	LM834N	LM834N
7494N	74LS94N	74594N	4094N	LM835N	LM835N
7495N	74LS95N	74595N	4095N	LM836N	LM836N
7496N	74LS96N	74596N	4096N	LM837N	LM837N
7497N	74LS97N	74597N	4097N	LM838N	LM838N
7498N	74LS98N	74598N	4098N	LM839N	LM839N
7499N	74LS99N	74599N	4099N	LM840N	LM840N

## TECH. INSTRUMENTS

**ICX SOCKETS**  
Body made of stainless steel with copper alloy contacts. Accommodates standard IC leads up to 0.14" thick, allowing for low insertion and high retention forces. Socket is designed to achieve maximum density on boards.

**SOLDER TAIL DIP SOCKETS**  
• Single beam  
• Low profile  
• YOUR CHOICE: TIN OR GOLD  
Minimum 50 microinch gold plating on gold sockets

**TIN PLATED SOLDER TAIL**  
Min. 200 Microinch Tin  
Part No. Description 1 10 100  
C8014 14 pin solder tail, tin 15 145 1200  
C8016 16 pin solder tail, tin 15 145 1200  
C8018 18 pin solder tail, tin 23 210 1700  
C8020 20 pin solder tail, tin 23 210 1700  
C8022 22 pin solder tail, tin 23 210 1700  
C8024 24 pin solder tail, tin 23 210 1700  
C8026 26 pin solder tail, tin 23 210 1700  
C8028 28 pin solder tail, tin 23 210 1700  
C8030 30 pin solder tail, tin 23 210 1700  
C8032 32 pin solder tail, tin 23 210 1700  
C8034 34 pin solder tail, tin 23 210 1700  
C8036 36 pin solder tail, tin 23 210 1700  
C8038 38 pin solder tail, tin 23 210 1700  
C8040 40 pin solder tail, tin 23 210 1700

**GOLD INLAY DIP SOCKETS**  
Min. 10 Microinch Gold  
Part No. Description 1 10 100  
C8014 14 pin solder tail, gold 40 420 4000  
C8016 16 pin solder tail, gold 40 420 4000  
C8018 18 pin solder tail, gold 40 420 4000  
C8020 20 pin solder tail, gold 40 420 4000  
C8022 22 pin solder tail, gold 40 420 4000  
C8024 24 pin solder tail, gold 40 420 4000  
C8026 26 pin solder tail, gold 40 420 4000  
C8028 28 pin solder tail, gold 40 420 4000  
C8030 30 pin solder tail, gold 40 420 4000  
C8032 32 pin solder tail, gold 40 420 4000  
C8034 34 pin solder tail, gold 40 420 4000  
C8036 36 pin solder tail, gold 40 420 4000  
C8038 38 pin solder tail, gold 40 420 4000  
C8040 40 pin solder tail, gold 40 420 4000

**WIRE WRAP DIP SOCKETS**  
• Standard profile  
• Universal pin receptacle  
• Contact accommodates 0.018" or round dual in-line leads  
• Wire wrap socket held to true position on board for efficient wire wrap  
• YOUR CHOICE: TIN OR GOLD  
Minimum 50 microinch gold plating on gold sockets

**TIN PLATED WIRE WRAP**  
Min. 200 Microinch Tin  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, tin 50 490 4800  
C8016 16 pin wire wrap, tin 50 490 4800  
C8018 18 pin wire wrap, tin 50 490 4800  
C8020 20 pin wire wrap, tin 50 490 4800  
C8022 22 pin wire wrap, tin 50 490 4800  
C8024 24 pin wire wrap, tin 50 490 4800  
C8026 26 pin wire wrap, tin 50 490 4800  
C8028 28 pin wire wrap, tin 50 490 4800  
C8030 30 pin wire wrap, tin 50 490 4800  
C8032 32 pin wire wrap, tin 50 490 4800  
C8034 34 pin wire wrap, tin 50 490 4800  
C8036 36 pin wire wrap, tin 50 490 4800  
C8038 38 pin wire wrap, tin 50 490 4800  
C8040 40 pin wire wrap, tin 50 490 4800

**GOLD INLAY WIRE WRAP**  
Min. 10 Microinch Gold  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, gold 40 420 4000  
C8016 16 pin wire wrap, gold 40 420 4000  
C8018 18 pin wire wrap, gold 40 420 4000  
C8020 20 pin wire wrap, gold 40 420 4000  
C8022 22 pin wire wrap, gold 40 420 4000  
C8024 24 pin wire wrap, gold 40 420 4000  
C8026 26 pin wire wrap, gold 40 420 4000  
C8028 28 pin wire wrap, gold 40 420 4000  
C8030 30 pin wire wrap, gold 40 420 4000  
C8032 32 pin wire wrap, gold 40 420 4000  
C8034 34 pin wire wrap, gold 40 420 4000  
C8036 36 pin wire wrap, gold 40 420 4000  
C8038 38 pin wire wrap, gold 40 420 4000  
C8040 40 pin wire wrap, gold 40 420 4000

**TECH. INSTRUMENTS**  
• Standard profile  
• Universal pin receptacle  
• Contact accommodates 0.018" or round dual in-line leads  
• Wire wrap socket held to true position on board for efficient wire wrap  
• YOUR CHOICE: TIN OR GOLD  
Minimum 50 microinch gold plating on gold sockets

**TIN PLATED WIRE WRAP**  
Min. 200 Microinch Tin  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, tin 50 490 4800  
C8016 16 pin wire wrap, tin 50 490 4800  
C8018 18 pin wire wrap, tin 50 490 4800  
C8020 20 pin wire wrap, tin 50 490 4800  
C8022 22 pin wire wrap, tin 50 490 4800  
C8024 24 pin wire wrap, tin 50 490 4800  
C8026 26 pin wire wrap, tin 50 490 4800  
C8028 28 pin wire wrap, tin 50 490 4800  
C8030 30 pin wire wrap, tin 50 490 4800  
C8032 32 pin wire wrap, tin 50 490 4800  
C8034 34 pin wire wrap, tin 50 490 4800  
C8036 36 pin wire wrap, tin 50 490 4800  
C8038 38 pin wire wrap, tin 50 490 4800  
C8040 40 pin wire wrap, tin 50 490 4800

**GOLD INLAY WIRE WRAP**  
Min. 10 Microinch Gold  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, gold 40 420 4000  
C8016 16 pin wire wrap, gold 40 420 4000  
C8018 18 pin wire wrap, gold 40 420 4000  
C8020 20 pin wire wrap, gold 40 420 4000  
C8022 22 pin wire wrap, gold 40 420 4000  
C8024 24 pin wire wrap, gold 40 420 4000  
C8026 26 pin wire wrap, gold 40 420 4000  
C8028 28 pin wire wrap, gold 40 420 4000  
C8030 30 pin wire wrap, gold 40 420 4000  
C8032 32 pin wire wrap, gold 40 420 4000  
C8034 34 pin wire wrap, gold 40 420 4000  
C8036 36 pin wire wrap, gold 40 420 4000  
C8038 38 pin wire wrap, gold 40 420 4000  
C8040 40 pin wire wrap, gold 40 420 4000

**TECH. INSTRUMENTS**  
• Standard profile  
• Universal pin receptacle  
• Contact accommodates 0.018" or round dual in-line leads  
• Wire wrap socket held to true position on board for efficient wire wrap  
• YOUR CHOICE: TIN OR GOLD  
Minimum 50 microinch gold plating on gold sockets

**TIN PLATED WIRE WRAP**  
Min. 200 Microinch Tin  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, tin 50 490 4800  
C8016 16 pin wire wrap, tin 50 490 4800  
C8018 18 pin wire wrap, tin 50 490 4800  
C8020 20 pin wire wrap, tin 50 490 4800  
C8022 22 pin wire wrap, tin 50 490 4800  
C8024 24 pin wire wrap, tin 50 490 4800  
C8026 26 pin wire wrap, tin 50 490 4800  
C8028 28 pin wire wrap, tin 50 490 4800  
C8030 30 pin wire wrap, tin 50 490 4800  
C8032 32 pin wire wrap, tin 50 490 4800  
C8034 34 pin wire wrap, tin 50 490 4800  
C8036 36 pin wire wrap, tin 50 490 4800  
C8038 38 pin wire wrap, tin 50 490 4800  
C8040 40 pin wire wrap, tin 50 490 4800

**GOLD INLAY WIRE WRAP**  
Min. 10 Microinch Gold  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, gold 40 420 4000  
C8016 16 pin wire wrap, gold 40 420 4000  
C8018 18 pin wire wrap, gold 40 420 4000  
C8020 20 pin wire wrap, gold 40 420 4000  
C8022 22 pin wire wrap, gold 40 420 4000  
C8024 24 pin wire wrap, gold 40 420 4000  
C8026 26 pin wire wrap, gold 40 420 4000  
C8028 28 pin wire wrap, gold 40 420 4000  
C8030 30 pin wire wrap, gold 40 420 4000  
C8032 32 pin wire wrap, gold 40 420 4000  
C8034 34 pin wire wrap, gold 40 420 4000  
C8036 36 pin wire wrap, gold 40 420 4000  
C8038 38 pin wire wrap, gold 40 420 4000  
C8040 40 pin wire wrap, gold 40 420 4000

**TECH. INSTRUMENTS**  
• Standard profile  
• Universal pin receptacle  
• Contact accommodates 0.018" or round dual in-line leads  
• Wire wrap socket held to true position on board for efficient wire wrap  
• YOUR CHOICE: TIN OR GOLD  
Minimum 50 microinch gold plating on gold sockets

**TIN PLATED WIRE WRAP**  
Min. 200 Microinch Tin  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, tin 50 490 4800  
C8016 16 pin wire wrap, tin 50 490 4800  
C8018 18 pin wire wrap, tin 50 490 4800  
C8020 20 pin wire wrap, tin 50 490 4800  
C8022 22 pin wire wrap, tin 50 490 4800  
C8024 24 pin wire wrap, tin 50 490 4800  
C8026 26 pin wire wrap, tin 50 490 4800  
C8028 28 pin wire wrap, tin 50 490 4800  
C8030 30 pin wire wrap, tin 50 490 4800  
C8032 32 pin wire wrap, tin 50 490 4800  
C8034 34 pin wire wrap, tin 50 490 4800  
C8036 36 pin wire wrap, tin 50 490 4800  
C8038 38 pin wire wrap, tin 50 490 4800  
C8040 40 pin wire wrap, tin 50 490 4800

**GOLD INLAY WIRE WRAP**  
Min. 10 Microinch Gold  
Part No. Description 1 10 100  
C8014 14 pin wire wrap, gold 40 420 4000  
C8016 16 pin wire wrap, gold 40 420 4000  
C8018 18 pin wire wrap, gold 40 420 4000  
C8020 20 pin wire wrap, gold 40 420 4000  
C8022 22 pin wire wrap, gold 40 420 4000  
C8024 24 pin wire wrap, gold 40 420 4000  
C8026 26 pin wire wrap, gold 40 420 4000  
C8028 28 pin wire wrap, gold 40 420 4000  
C8030 30 pin wire wrap, gold 40 420 4000  
C8032 32 pin wire wrap, gold 40 420 4000  
C8034 34 pin wire wrap, gold 40 420 4000  
C8036 36 pin wire wrap, gold 40 420 4000  
C8038 38 pin wire wrap, gold 40 420 4000  
C8040 40 pin wire wrap, gold 40 420 4000

**TECH. INSTRUMENTS**  
• Standard profile  
• Universal pin receptacle  
• Contact accommodates 0.018" or round dual in-line leads







ramsey

the first name in Counters !



9 DIGITS 600 MHz \$129<sup>95</sup> WIRED

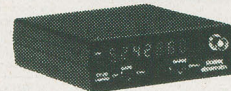
**PRICES:**  
CT-90 wired, 1 year warranty \$129.95  
CT-90 Kit, 90 day parts warranty 109.95  
AC-1 AC adapter 3.95  
BP-1 Nicad pack + AC Adapter/Charger 12.95  
OV-1, Micro-power Oven time base 49.95  
External time base input 14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

**SPECIFICATIONS:**

Range: 20 Hz to 600 MHz  
Sensitivity: Less than 10 MV to 150 MHz  
Less than 50 MV to 500 MHz  
Resolution: 0.1 Hz (10 MHz range)  
1.0 Hz (60 MHz range)  
10.0 Hz (600 MHz range)  
Display: 9 digits 0.4" LED  
Time base: Standard-10,000 mHz, 1.0 ppm 20-40°C.  
Optional Micro-power oven-0.1 ppm 20-40°C  
Power: 8-15 VAC @ 250 ma

7 DIGITS 525 MHz \$99<sup>95</sup> WIRED



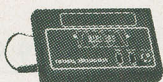
**SPECIFICATIONS:**

Range: 20 Hz to 525 MHz  
Sensitivity: Less than 50 MV to 150 MHz  
Less than 150 MV to 500 MHz  
Resolution: 1.0 Hz (5 MHz range)  
10.0 Hz (50 MHz range)  
100.0 Hz (500 MHz range)  
Display: 7 digits 0.4" LED  
Time base: 1.0 ppm TCXO 20-40°C  
Power: 12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

**PRICES:**

CT-70 wired, 1 year warranty \$99.95  
CT-70 Kit, 90 day parts warranty 84.95  
AC-1 AC adapter 3.95  
BP-1 Nicad pack + AC adapter/charger 12.95



7 DIGITS 500 MHz \$79<sup>95</sup> WIRED

**PRICES:**

MINI-100 wired, 1 year warranty \$79.95  
AC-Z Ac adapter for MINI-100 3.95  
BP-Z Nicad pack and AC adapter/charger 12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

**SPECIFICATIONS:**

Range: 1 MHz to 500 MHz  
Sensitivity: Less than 25 MV  
Resolution: 100 Hz (slow gate)  
1.0 KHz (fast gate)  
Display: 7 digits, 0.4" LED  
Time base: 2.0 ppm 20-40°C  
Power: 5 VDC @ 200 ma

8 DIGITS 600 MHz \$159<sup>95</sup> WIRED



NEW  
READ  
RECEIVER  
FREQUENCY

**SPECIFICATIONS:**

Range: 20 Hz to 600 MHz  
Sensitivity: Less than 25 mv to 150 MHz  
Less than 150 mv to 600 MHz  
Resolution: 1.0 Hz (60 MHz range)  
10.0 Hz (600 MHz range)  
Display: 8 digits 0.4" LED  
Time base: 2.0 ppm 20-40°C  
Power: 110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

**PRICES:**

CT-50 wired, 1 year warranty \$159.95  
CT-50 Kit, 90 day parts warranty 119.95  
RA-1, receiver adapter kit 14.95  
RA-1 wired and pre-programmed (send copy of receiver schematic) 29.95



DIGITAL MULTIMETER \$99<sup>95</sup> WIRED

**PRICES:**

DM-700 wired, 1 year warranty \$99.95  
DM-700 Kit, 90 day parts warranty 79.95  
AC-1, AC adaptor 3.95  
BP-3, Nicad pack + AC adapter/charger 19.95  
MP-1, Probe kit 2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

**SPECIFICATIONS:**

DC/AC volts: 100uV to 1 KV, 5 ranges  
DC/AC current: 0.1 uA to 2.0 Amps, 5 ranges  
Resistance: 0.1 ohms to 20 Megohms, 6 ranges  
Input impedance: 10 Megohms, DC/AC volts  
Accuracy: 0.1% basic DC volts  
Power: 4 'C' cells

**AUDIO SCALER**

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

**ACCESSORIES**

Telescopic whip antenna - BNC plug. . . . . \$ 7.95  
High impedance probe, light loading . . . . . 15.95  
Low pass probe, for audio measurements . . . . . 15.95  
Direct probe, general purpose usage . . . . . 12.95  
Tilt bail, for CT 70, 90, MINI-100 . . . . . 3.95  
Color burst calibration unit, calibrates counter against color TV signal. . . . . 14.95

**COUNTER PREAMP**

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

ramsey electronics, inc.

2575 BAIRD RD. • PENFIELD, NY 14526



PHONE ORDERS  
CALL 716-586-3950

**TERMS**

Satisfaction guaranteed - examine for 10 days if not pleased, return in original form for refund. Add 5% for shipping, insurance to a maximum of \$10. Overseas add 15% COD, add \$2. Orders under \$10, add \$1.50. NY residents, add 7% tax.

CIRCLE 51 ON FREE INFORMATION CARD

DECEMBER 1982

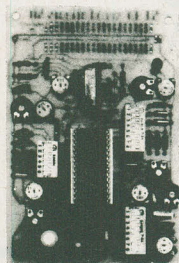
131



# BEC BULLET ELECTRONICS

P.O. BOX 401244R GARLAND, TX. 75040 (214) 278-3553

## Sound Effects Kit \$18.50

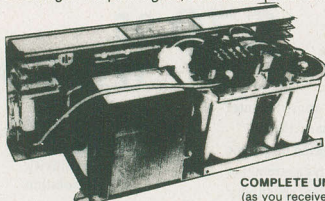


The SE-01 is a complete kit that contains all the parts to build a programmable sound effects generator. Designed around the new Texas Instruments SN76477 Sound Chip, the board provides banks of MINI DIP switches and pots to program the various combinations of the S.F. Oscillator, VCO, Noise, One Shot, and Envelope Controls. A Quad Op Amp IC is used to implement an Adjustable Pulse Generator. Level Comparator and Multiplex Oscillator for even more versatility. The 3" x 5" PC Board features a prototype area to allow for user added circuitry. Easily programmed to duplicate Explosions, Phasor Guns, Steam Trains, or almost an infinite number of other sounds. The unit has a multiple of applications. The low price includes all parts specifications. It runs on a 9V battery (not included). On board 100MW amp will drive a small speaker directly, or the unit can be connected to your stereo with incredible results! (Speaker not included). 76477 is included. Available separately for \$3.15 each.

## 7 Watt Audio Amp Kit \$6.95

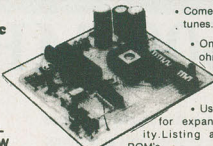
SMALL, SINGLE HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

3 OUTPUTS  
12V @ 8A (12A Int.)  
5V @ 10A  
-12V @ 5A  
INPUT 105 - 125VAC



COMPLETE UNIT  
(as you receive it)

## The Super Music Maker REVISION 2 \$24.95 (Basic Kit) SEE SPECIAL OFFER BELOW



- Comes with 25 pre-programmed tunes.
- On board 7 watt amplifier drives 8 ohm speaker directly.
- Works on 12VAC or 12 VDC.
- Uses either 2708 or 2716 EPROM for expanded tune playing capability. Listing available pre-programmed ROMs.

A true electronic music maker based on a microprocessor chip. The Super Music Maker is the only kit that allows easy addition of pre-programmed tunes by plugging in one memory chip (ROM). Over 20 different ROM's with over 500 tunes are available. Use the kit for a Car Horn, Doorbell, Door Announcer, etc. If you have an EPROM programmer our manual tells you how to program your own tunes. Kit includes quality plated and drilled PC Board and all components.

### OPTIONAL ACCESSORIES

- DIP SWITCHES One 8 pos., one 5 pos., for tune address ..... 2.00/set
- WALL PLUG TRANSFORMER For operation on 117VAC house current ..... 3.00
- INJECTION MOLDED PLASTIC CASE w/custom front & rear panels, hardware ..... 8.00
- and 2 five pos. rotary switches (replaces DIP switches) ..... 6.25
- HORN SPEAKER 8 watt, 8 Ohm with mounting bracket ..... 6.25

### SPECIAL OFFER

Buy a Super Music Maker kit for \$24.95 and get FREE, a 2708 ROM pre-programmed with 35 popular tunes. This offer gives you over 60 songs to choose from!

## Doomsday Alarm Kit \$9.95

If you have trouble sleeping and you would like the rest of the neighborhood to share your misery then this little kit will be for you! There is no way to accurately describe the unearthly howls, screams and tones that come out of this kit. Four separate tone oscillators are mixed, cancelled and stepped at a varying rate. 10 Watts of crazy sounds. A great fun kit or a practical burglar alarm. Complete with PC board and all necessary components less speaker. For 6-12 VDC. ORDER DA-02.

- UNIT IS COMPLETELY ASSEMBLED!
- Fused primary and DC sections
- HUGE SHIELDED TRANSFORMER
- 2% Load & Line Regulation
- Low Ripple <100mV
- Short Circuit Protection
- Overvoltage Protection on all three outputs
- 25A Bridge Rectifier
- Over 80,000 mfd of filters
- High Efficiency Switching Regulator reduces heatsink area
- Schematics and service guide included
- Thermal Shutdown
- Static LED's (3)

62.50

Plus \$5.00 Freight

21 lbs. 6 x 5 1/2 x 12

ONE TIME OFFER! LIMIT TWO (2) SUPPLIES PER CUSTOMER.

- \* COD MINIMUM \$20.00 + ADD \$2.50 FOR COD'S
- \* UPS DELIVERY ADDRESS MUST ACCOMPANY ALL COD ORDERS
- \* \$1.00 HANDLING ON ORDERS UNDER \$10.00
- \* VISA, MC CARDS OR CHECK
- \* ADD 6% FOR SHIPPING
- \* TEXAS RESIDENTS ADD 5% STATE SALES TAX
- \* ALL FOREIGN ORDERS ADD 25% FOR SHIPPING (CANADA 15%) NO FOREIGN COD'S
- \* CALL (214) 278-3553 TO PLACE CREDIT CARD OR COD ORDER

## THE PRESIDENT SAYS: "HOGWASH!!"

After taking one look at the TRIPUT POWER SUPPLY our engineer declared that the units were worth several hundred dollars each. He pointed out the engineering, high quality construction and state-of-the-art integrated design in support of his position. The President of BEC more pragmatically pointed out the already full warehouse and the two trailer truck loads of power supplies waiting in the parking lot, and set the price to move them QUICKLY!

# SCR™

## Free Buyers Guide

84 pages of the latest in components, tools and instruments — a must for DESIGNERS, instructors and maintenance engineers.

## NEW ZENITH ZXM 121

High legibility 12" green phosphor monitor. 15 Mhz bandwidth, 40 or 80 character selectable full compatibility.. \$117.00

## OVERSTOCK SPECIALS



3" Rotor Fan  
New..... \$10.95

VU Meters ..... 99¢ Ea.

470K 1/4W Resistor ..... \$2.00/1000



24 VAC 500 MA  
Plug in transformer. .... \$4.50



UHF/VHF Conversion  
Kit — with  
Genuine Mitsumi  
Tuner. .... \$119.98

## CALL OUR HOT LINES

IN CALIF. (714) 527-2554  
OUTSIDE CAL. (800) 854-8660

## SCR ELECTRONICS CENTER

5303 Lincoln Ave., Cypress, CA 90630

CIRCLE 86 ON FREE INFORMATION CARD



## CALIFORNIA COMPUTER SYSTEMS

### \$100

2032 32K STATIC RAM A & T.	
200 NSEC	\$468.00
2116 16K STATIC RAM A & T.	
200 NSEC	\$279.50
2065 64K DYNAMIC RAM A & T.	\$351.00
2200 S-100 MAIN FRAM A & T.	\$500.00
2422A FLOPPY DISC WITH CP/M 2.2"	\$372.50
2831A ARITHMETIC PROCESSOR A & T.	\$552.50
2810A Z80 CPU A & T.	\$281.25
2710A 4 SERIAL 1/0 A & T.	\$291.95
2501A 12 SLOT MOTHER BOARD	\$180.00
2720A 4 PARALLEL A & T.	\$214.95
PROTO BOARDS WW	\$39.95

### APPLE PRODUCTS

7114A 12K ROM/PROM	\$99.95
7424A CALENDAR/CLOCK	\$106.95
7440A PROGRAMMABLE TIMER	\$106.95
7470A A TO D CONVERTER	\$105.95
7490A GPIB (IE 488) INTERFACE	\$182.00
7710A ASYNC SERIAL	\$125.95
7712A SYNC SERIAL	\$148.50
7720A PARALLEL STANDARD	\$105.00
7720B PARALLEL CENTRONICS	\$105.00
7811B ARITHMETIC PROCESSOR W/DISC	\$325.00
7811C ARITHMETIC PROCESSOR W/ROM	\$325.00
7520A EXTENDER	\$23.50
7300A APPLE CLIP	\$8.00

### SOFTWARE

23-01 CP/M™ MACRO ASSEMBLER ON DISK	\$76.95
24-01 CP/M™ SYMBOLIC INSTRUCTION DEBUGGER	\$64.25
25-01 CP/M™ TEXT FORMATER	\$64.25
26-01 CP/M™ BACKGROUND PRINT UTILITY	\$42.95

OTHER CCS PRODUCTS ARE AVAILABLE.  
CALL FOR PRICE.



## MICROCOMPUTER PRODUCTS

### \$100 PRODUCTS

CB1A 8080 PROCESSOR PCBD	\$36.95
KIT	\$155.95, A & T
CB-2 280 PROCESSOR BOARD	
KIT	\$198.95, A & T
VBIC 64 x 16 VIDEO, PCBD	\$36.95
KIT	\$153.95, A & T
VB2 64 x 16 VIDEO, PCBD	\$32.95
KIT	\$175.95, A & T
VB3 80 CHARACTER VIDEO 4MHZ	
KIT	\$345.95, A & T
UPGRADE RAMS FOR VB-3	\$42.00
I04 2 PARALLEL, 2 SERIAL, PCBD	\$36.95
KIT	\$160.95, A & T
PB-1 2708, 2716 PROGRAMMER BOARD	
KIT	\$140.95, A & T
MB-10 16K STATIC RAM	
KIT	\$299.95, A & T

### APPLE PRODUCTS

A488 IEEE 488 INTERFACE	\$399.95
A10 - II SERIAL/PARALLEL INTERFACE	
A & T	\$178.00
ASIO SERIAL I/O	
A & T	\$115.95
APIO PARALLEL I/O W/O CABLES	
A & T	\$87.95

OTHER SSM PRODUCTS ARE AVAILABLE.  
CALL FOR PRICES.



MONDAY-FRIDAY, 8:00 TO 12:00, 1:00 TO 5:30  
THURSDAYS, 8:00 TO 9:00 P.M.

(415) 728-9121

P.O. BOX 955 • EL GRANADA, CA 94018

PLEASE SEND FOR IC, XISTOR AND COMPUTER PARTS LIST

CIRCLE 66 ON FREE INFORMATION CARD

## DEC. SPECIAL SALE ON PREPAID ORDERS

(CHARGE CARDS, C.O.D. OR P.O.'S NOT AVAILABLE)  
MUST MENTION AD FOR SPECIAL PRICES

### XMAS SPECIAL SALE

5% OFF ON SSM KITS, WAMECO BARE BOARDS, WAMECO BARE BOARDS WITH MIKOS PARTS, EXTEK KITS.

### 74 LS™ SERIES PRIME PARTS

EA 5 FOR	EA 5 FOR	EA 5 FOR
LS00 .25 1.23	LS132 .75 3.56	LS197 .85 4.04
LS02 .25 1.23	LS136 .50 2.38	LS221 1.15 5.46
LS04 .25 1.23	LS138 .75 3.56	LS240 1.80 8.55
LS05 .25 1.23	LS139 .75 3.56	LS243 1.75 8.31
LS08 .35 1.66	LS145 1.20 5.70	LS244 1.75 8.31
LS10 .25 1.23	LS147 2.49 -	LS245 2.15 -
LS13 .45 2.14	LS148 1.35 -	LS251 1.00 4.75
LS14 .99 4.50	LS151 .75 3.56	LS257 .85 4.04
LS20 .25 1.23	LS153 .75 3.56	LS258 .85 4.04
LS26 .35 1.66	LS155 .90 4.28	LS260 .65 -
LS27 .35 1.66	LS156 .90 4.28	LS266 .46 2.19
LS30 .25 1.23	LS157 .75 3.56	LS279 .50 2.38
LS32 .35 1.66	LS158 .75 3.56	LS290 .80 3.80
LS37 .55 2.50	LS160 .90 4.28	LS293 .80 3.80
LS38 .35 1.66	LS161 .95 4.51	LS295 1.05 4.99
LS42 .55 2.50	LS162 .95 4.51	LS367 .70 3.33
LS74 .45 2.14	LS163 .95 4.51	LS368 .70 3.33
LS75 .50 2.38	LS164 .95 4.51	LS373 1.85 8.79
LS85 1.15 5.46	LS166 1.75 8.31	LS374 1.80 8.55
LS86 .40 1.90	LS173 .80 3.80	LS377 1.45 6.89
LS90 .60 2.85	LS174 .95 4.51	LS378 1.18 5.61
LS92 .60 2.85	LS175 .95 4.51	LS820 2.25 -
LS93 .60 2.85	LS190 1.00 4.75	LS826 2.25 -
LS122 .45 2.14	LS191 1.00 4.75	LS829 1.44 -
LS123 .95 4.50	LS192 .85 4.04	LS882 3.20 -
LS125 .90 4.28	LS193 .95 4.51	LS883 2.30 -
LS126 .75 3.56	LS196 .85 4.04	LS888 2.40 -

QUANTITY OF 5 FOR MUST BE OF THE SAME DEVICE. THEY MAY NOT BE MIXED. AN ADDITIONAL 5% OFF PURCHASES OVER \$50 ON LS PARTS ON PREPAID ORDERS BY CHECK OR MONEY ORDER ONLY.

VISA or MASTERCARD. Send account number, interbank number, expiration date and sign your order. Approx. postage will be added. Orders with check or money order will be sent post paid in U.S. If you are not a regular customer, please use charge, cashier's check or postal money order. Otherwise there will be a two-week delay for checks to clear. Calif. residents add 6.5% tax. Money back 30-day guarantee. We cannot accept returned IC's that have been soldered to. Prices subject to change without notice. \$20 minimum order. \$2.00 service charge on orders less than \$20.00.





## AMAZING DEVICES

PHASORS

**PHASOR PAIN FIELD** — Patented and recently developed in our labs is being tested by Gov't for riot control. Soon to come under weapons restrictions as an infernal machine. Easily hand-held. Hazardous IF NOT USED WITH DISCRETION.

PPF-1 PLANS (sold for animal control) . . . \$15.00

**INVISIBLE PAIN FIELD GENERATOR** — Produces a directional field of moderately intense pain to back of head up to 50'. Cigarette pack size enclosure is easily hidden.

IPG-3 PLANS . . . \$7.00 IPG-3K KIT & PLANS . . . \$44.50

IPG-30 (assembled for animal control) . . . \$59.50

**PHASOR STUN/BURNING WAND** — Produces sufficient electrical energy capable of burning flesh. Intended as a personal defense device.

PSW-3 PLANS . . . \$8.00 PSW-3K KIT & PLANS . . . \$59.50

LASERS

**RUBY LASER RAY PISTOL** — Intense visible red, burns, hazardous, with parts sources.

RUBY PLANS (includes all part sources) . . . \$15.00

**CARBON DIOXIDE LASER** — Generates 20-40 watts of continuous power capable of burning, cutting, hazardous. (with all part sources) . . . \$15.00

**LASER RIFLE** — Produces 200-3000 pulses of 30 watt optical energy. Portable and easily hand-held.

LRG-3 PLANS . . . \$10.00

LRG-3K KIT PLANS (minus diode) . . . \$129.50

**POCKET LASER** — For the beginner, visible red "optical version", non-hazardous.

LHC-2 . . . \$5.00 LHC-2K KIT & PLANS . . . \$24.50

**HIGH POWERED PORTABLE ENERGY SOURCE FOR LASERS AND MAGNETIC WEAPONS** — Exploding wires, shockwave, etc. Miniature size.

HPS-1 PLANS . . . \$8.00 HPS-1K KIT & PLANS . . . \$49.50

**PARTICLE BEAM WEAPON** — PLANS . . . \$15.00

SECURITY

**INFINITY XMTR** — Uses telephone lines for selective home or office listening while away on business or vacation.

INF-1 PLANS . . . \$15.00

**SEE IN DARK** — Long range, total darkness.

SD-4 PLANS . . . \$10.00

**LONG RANGE WIRELESS MIKE** — Crystal clear quality — miniature.

FBT-7 PLANS . . . \$7.00 FBT-7K PLANS & KIT . . . \$34.50

**WIRELESS TELEPHONE TRANSMITTER** — Long range, automatic.

VWPM-5 PLANS \$10.00 VWPM-5K PLANS & KIT \$34.50

Send for **FREE** catalog description of above plus hundreds more plans, kits and completed items. We accept MC or Visa or when ordering, send check or money order. We pay shipping charges on orders over \$50.00, otherwise include 10% with remittance.

SEND TO: **SCIENTIFIC SYSTEMS**

DEPT. R8, BOX 716, AMHERST, N.H. 03031

CIRCLE 83 ON FREE INFORMATION CARD

# ELECTRONIC KITS for school and hobbyists

Buy direct from the manufacturer at wholesale prices.

**Why pay more?** Selling over 10 yrs. to the school market. Kit prices start at \$2.25. **Teachers:** For additional savings, have your students combine their orders for maximum discount and minimum shipping cost.

Large 1/16" thick drilled and etched P.C. boards. Kits include detailed pictorial instructions for easy assembly, complete with all parts including wire and solder. Plastic cases available for all projects for maximum safety and project appearance.

## FREE CATALOG

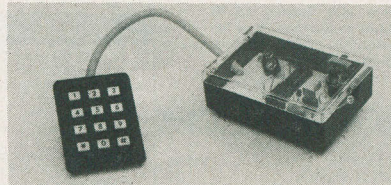
Phone 1 (800) 421-6546

MASTER CHARGE AND VISA ACCEPTED

In California (213) 450-1600.

8:30 A.M.-3 P.M. P.S.T.

Large 8 1/2 x 11" 1982-83 Catalog. Includes projects such as Neon Flasher, Strobe Light, TV Jammer, Color Organ, Telephone Hold Button, 0-15V Power Supply, 12V Strobe, IC Radio and more. Typical project shown below:

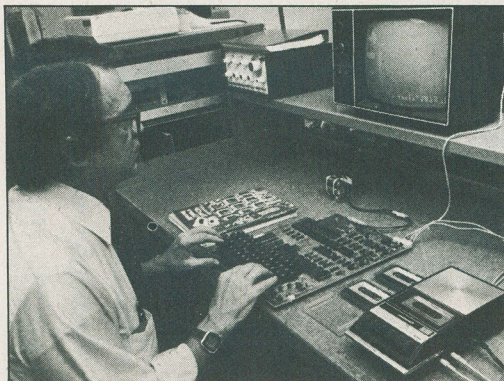


**Model 660 DK Keyboard Digital Control** used for: Auto anti-theft, door alarm control, door lock control.

Kit of all parts \$18.95 Drilled & etched PCB \$3.50 Plastic case kit \$1.75 Shipping and handling \$2.50

# HALLBAR

Hallbar Educational Research, Inc.  
P.O. Box 2019, Santa Monica, CA 90406



Plus Sensational Limited-Time Savings On Ohio Scientific C1P Series personal computers, Superboard and C1P accessories, spare replacement parts, printers, monitors, integrated circuits, and other computer-related components.

### To Order

Call us directly or return order coupon with your check, money order, or Mastercard or Visa Account Number. Orders will normally be shipped within 48 hours after receipt. \$100.00 minimum order.

### FREE

Sampler Cassettes with each Superboard II and C1P series order!

Taxi (Game), Electronic Equations, Loan Finance, Straight and Constant Depreciation, Uneven Cash Flows

Tiger Tank, Flip Flop, (Logic Game), Hectic, Black Jack, Master Mind

# Super Sale!

## 40% Off On Ohio Scientific Superboard II A Complete Computer System On A Board

Includes full-size 53-key keyboard, video and audio cassette interfaces; SWAP, Modem, sampler cassettes; manual; 8K BASIC-in-ROM, with 8K RAM. Requires 5-V/3 amp regulated DC power supply. 30-day limited warranty. Supply is limited. ONLY \$200.00



**Cleveland Consumer Computers & Components**

1333 S. Chillicothe Road, Aurora, OH 44202

TO ORDER: CALL 1-800-321-5805 TOLL FREE

(Ohio Residents Call 216-562-4136)

☐ SUPERBOARD II, \$200.00

☐ Send Detailed Catalog/Order Form

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Payment by enclosed check or money order or charge to:

☐ MasterCard

☐ VISA

Account # \_\_\_\_\_ Expiration Date \_\_\_\_\_

Total Amount Charged or Enclosed \$ \_\_\_\_\_

Ohio Residents Add 5.5% Sales Tax. All Orders Will Be Shipped Insured By UPS Unless Requested Otherwise.

CIRCLE 63 ON FREE INFORMATION CARD



# B. G. MICRO

P. O. Box 280298 Dallas, Texas 75228

(214) 271-5546

Visa • MasterCard • American Express

## STATIC RAM

21L02-1KX1 250 n.s.	
Low Power	.75
2114L-3 1KX4 300 n.s.	
Low Power	2.75 8/17.50
HM6116P-4 2KX8 + 5v-200 n.s.	
CMOS Low Power 2716	
Style Pin Out	8/56.00
TMM2016-2KX8 - 5v-HMOS	
200 n.s. - 2716 Style	
Pin Out	8/56.00
6501-5 256X4 - CMOS - Data	
Retention 2 Volts - 22 Pin - 200 n.s.	
Typ. 5V Very Low Power	1.50
6514 J-5 1KX4-CMOS Super Low	
Power 350 n.s. Similar to 2114	
Same Pin Out	2.00
8108-5 1KX8 NMOS 5V 500 NS	
22 Pin	2.00

4K STATIC RAMS  
LESS THAN 94¢ EACH  
MK4104J-4 - 250 N.S. 18 Pin Ceramic  
Computer Mfg. Surplus. PRIME. Fully  
Static easy to Use. Has Same Pin Out as  
TMS4044, but slightly different timing.  
With Specs. (Mostek)  
8 for 8.95 32 for 29.95  
VERY LOW POWER!

## DYNAMIC RAM

5280N-5 (2107B-4 • TMS4060)	
4KX1 22 Pin	8/3.95
4027-4KX1-250 n.s.	1.75
4116-16KX1-250 n.s.	8/10.00
4116-16KX1-200 n.s.	8/11.50
4164- +5v 64K	8/64.00

PRECISION HYBRID  
OSCILLATOR MODULE  
Has both 1 MHz and 2 MHz TTL - outputs -  
Hermetically sealed - Ultra high stability over  
wide temp. range - originally cost over \$40.00  
each - we made a super purchase from a major  
computer manufacturer - 5 Volt operation - fits  
standard 24 pin socket - Manufactured by  
Motorola oscillator division 7.50 (w/data)  
MC6871A 3/20.00

## SOCKETS

Low Profile Solder	
8 Pin	13/1.00
14 Pin	10/1.00
16 Pin	8/1.00
18 Pin	8/1.00
20 Pin	7/1.00
24 Pin	6/1.00
28 Pin	6/1.00
40 Pin	5/1.00

Buy \$10 Get \$1.00  
FREE CHOICE

## CPU

8035	5.95
8039	6.95
8748 Intel	15.95
6802	5.50
6100	4.50

## 74LS

LS00	.24	LS125	.95	LS243	1.49
LS02	.24	LS138	.79	LS244	.99
LS04	.24	LS139	.79	LS245	1.95
LS05	.24	LS151	.79	LS257	.79
LS08	.24	LS153	.79	LS266	.59
LS10	.24	LS154	1.75	LS283	.99
LS14	.89	LS157	.79	LS290	.99
LS20	.24	LS161	.99	LS293	1.75
LS27	.24	LS164	.99	LS298	.89
LS30	.24	LS166	.99	LS367	.79
LS32	.36	LS175	.89	LS368	.79
LS42	.49	LS181	1.99	LS373	.99
LS74	.44	LS192	.89	LS374	1.49
LS85	.95	LS193	.89	LS375	1.19
LS86	.39	LS221	1.10	LS377	1.49
LS90	.69	LS240	.99	LS390	1.19
LS109	.39	LS241	.99	LS393	1.19
LS123	.99	LS242	1.49	LS399	.99

## MISCELLANEOUS

AY3-8910-Sound Chip with 60	
page data manual	9.95
DM8131 6 Bit Unified Bus	
Comparator	2.99
8 Pin Dip Shunt	3/1.00
TR1602-UART same as	
AY5-1013	1.99
IM6402-+5v High speed	
UART-AY5-1013 pin out	2.00
MC1408L6 D to A Converter	
8 Bit	1.79
AD561J D to A Converter	
10 Bit	1.79
1771 Single Density FDC	20.00
1791 Double Density FDC	23.50
5027-CRT Controller -	
Programmable - 24 x 80	14.95
68B45 - Motorola (HD46505SP)	
CRT Controller	17.50
82S123-32K8 Tri State Bi polar	
PROM	1.99
82S129 Tri State Bi Polar Prom	1.99

## EPROM

1702A 256X8 1 us	2.00
2708 1KX8 450 n.s.	2.20
27A08 1KX8 350 n.s.	3.95
2716 2KX8+5v	
450 n.s.	3.20
2716-1 2KX8+5v 350 n.s.	7.95
2732 4KX8 450 n.s. Intel Pin Out	6.95
2732A-3 4K x 8 350 n.s.	
Intel Pin Out Low Power	8.95
2532 4KX8 450 n.s. T.I. Pin Out	7.50

## Z80

Z80 2.5 MHZ CPU	4.00
Z80DMA-DMA Controller	9.95
Z80PIO - Parallel	5.95
Z80SIO/O Chan. Ser.	16.95
Z80A-4MHZ CPU	6.95
Z80A SIO/O	19.95

WE HAVE A BRAND NEW FLYER. CALL OR WRITE FOR MANY NEW ITEMS

TERMS: Add \$1.50 postage, we pay balance. Orders over \$50.00 add 85¢ for insurance. No C.O.D. Texas Res. add 5% Tax. 90 Day Money Back Guarantee on all items. All items subject to prior sale. Prices subject to change without notice. Foreign order - U.S. funds only. We cannot ship to Mexico. Countries other than Canada, add \$3.50 shipping and handling.

CIRCLE 70 ON FREE INFORMATION CARD

## ELECTRONIC KITS FROM HAL-TRONIX

2304 MHZ DOWN CONVERTERS. TUNES IN ON CHANNELS 2 TO 7 ON YOUR OWN HOME T.V. HAS FREQUENCY RANGE FROM 2000 MHZ TO 2500 MHZ. EASY TO CONSTRUCT AND COMES COMPLETE WITH ALL PARTS INCLUDING A DIE-CAST ALUM CASE AND COAX FITTINGS, REQUIRE A VARIABLE POWER SUPPLY AND ANTENNA (Antenna can be a dish type or coffee can type depending on the signal strength in your area.)

2304 MOD 1 (Basic Kit) \$19.95

2304 MOD 2 (Basic / Pre-amp) \$29.95

2304 MOD 3 (Hi-Gain Pre-amp) \$39.95

POWER SUPPLY FOR EITHER MODEL ABOVE IS AVAILABLE. COMES COMPLETE WITH ALL PARTS, CASE, TRANSFORMER, ANTENNA SWITCH AND CONNECTORS (Kit) \$24.95

Assembled.....\$34.95

Slotted Microwave Antenna For Above

Downconverters.....\$39.95

## PREAMPLIFIERS

HAL PA-19—1.5 mhz to 150 mhz. 19db gain operates on 8 to 18 volts at 10ma. Complete unit \$8.95.

HAL PA-1.4—3 mhz to 1.4 ghz. 10 to 12 db gain operates on 8 to 18 volts at 10ma. Complete unit \$12.95.

(The above units are ideal for receivers, counters, etc.)

16 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS .....\$69.95

12 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS .....\$39.95

16 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS ....\$39.95

12 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS ....\$29.95

MANY, MANY OTHER KITS AVAILABLE

Send 20 cents stamp or S.A.S.E. for information and flyer on other HAL-TRONIX products. To order by phone: 1-313-285-1782.



HAL-TRONIX

P.O. Box 1101

Southgate, MI 48195

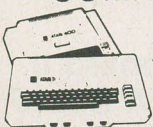
## SHIPPING

INFORMATION

ORDERS OVER \$25.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN \$25.00 PLEASE INCLUDE ADDITION: AL \$2.00 FOR HANDLING AND MAILING CHARGES.

CIRCLE 34 ON FREE INFORMATION CARD

## COMPUTERS ATARI® 800™ COMPUTER SYSTEM



800w/16K \$699.00  
\*800 Computer w/48K  
★BEST BUY★  
\$790.00

## ATARI PERIPHERALS:

Printer '825 - 65000	Asteroids
Disk Dr: 810 - 48500	Missile Com
Record '410 - 8200	Sup Brk Out
Paddle (pr)	Assen Edit - 4900
Joystick (pr)	Star Raiders - 4500
32k RAM - 179.95	Basketball - 2800
Basic Cart - 4900	Chess - 3200
Pac-Man or Centipede	→ \$36.95 each

SUPER 5amp. POWER SUPPLY  
for APPLE → \$124.00 ★

## Diskette Storage BOX

5 1/4 in. > 5/8 in. > 5/8 in.  
\$2.50 ea. \$10.00 \$3.50 \$15.00

Bare Bones APPLE II  
EURO

w/o Keyboard = 48K RAM =

\$450.

w/o Pwr. Supply

Microswitch	Power Supply	APPLE
Keyboard	w/ Purchase	Reference Manl.
\$79.95	\$105.00	\$18.00

## \*SPECIALS\*

3inch Mini FAN → \$8.95
2111 → \$2.45
8155 → \$11.50
ER2501 → \$4.95
AY5 1013A → \$2.95
8202 → \$29.95
6522 → \$5.25
8255 → \$4.50
8748-8 → \$31.00
MC6800 → \$7.75
MC6802 → \$14.95
MC6850 → \$4.50
MC6821 → \$4.95
6331 → \$1.25

4116-2 → 8/ 1200
2716(5v) → 3.75ea.
2732(5v) → 8.75ea.
2532(5v) → 8.75ea.
Z80 A CPU → 5.25ea.

1982 I.C.  
(2vol.) Master  
\$59.95

## Diskette SALE!!

"Wabash"

5 1/4	8inch
SS/SD \$22.00	\$25.00
SS/DD 27.40	30.40
DS/SD 0	34.90
DS/DD 32.40	37.40

## CONCORD COMPUTER PRODUCTS

2910 B. E. LA PALMA

ANAHEIM CA 92806

(714) 632-6790

10 MIN ORDER C.A.R.S. ADD 6% ALLOW. 7 MINS DEL. T.F. PERSONAL CHECK IS SENT

Freight \$10 - 49 \$200 - 499 \$900 - 999 \$1100 - 240 - 800 1000 - UP - Call catalog

## MONITORS

ZENITH # ZVM-121

12in. 15MHZ./GREEN Phos.

\$107.00

J.C.S.#KG-12

12in. 19MHZ./GREEN Phos.

Non-Glare Screen \$134.50

BMC#BM-12A

12in. 15MHZ./GREEN Phos.

\$84.50

BMC #BM-1400CL

13in."COLOR"

\$325.00

## REAL-TIME CLOCK

CALENDAR (MSM 5832)

Description Mono Metal Gate CMOS I.C.

Features

Time, Month, Date, Year, &

Day of Week

\*Bus Oriented

\*4 Bit Data Bus

\*4 Bit Address

\*R/W Hold Selec.

\*Inter Signal

\*32 768KHz xtal Control

\*5v Pow Sup

\*Low Power Dissipation

\$6.45

XTAL

\$1.50

## COMPONENTS

### 7400 SERIES

7400	18	7454	19
7401	18	7470	38
7402	18	7472	38
7403	18	7474	38
7404	18	7475	38
7405	18	7476	38
7406	18	7477	38
7407	18	7478	38
7408	18	7479	38
7409	18	7480	38
7410	18	7481	38
7411	18	7482	38
7412	18	7483	38
7413	18	7484	38
7414	18	7485	38
7415	18	7486	38
7416	18	7487	38
7417	18	7488	38
7418	18	7489	38
7419	18	7490	38
7420	18	7491	38
7421	18	7492	38
7422	18	7493	38
7423	18	7494	38
7424	18	7495	38
7425	18	7496	38
7426	18	7497	38
7427	18	7498	38
7428	18	7499	38
7429	18	7500	38
7430	18	7501	38
7431	18	7502	38
7432	18	7503	38
7433	18	7504	38
7434	18	7505	38
7435	18	7506	38
7436	18	7507	38
7437	18	7508	38
7438	18	7509	38
7439	18	7510	38
7440	18	7511	38
7441	18	7512	38
7442	18	7513	38
7443	18	7514	38
7444	18	7515	38
7445	18	7516	38
7446	18	7517	38
7447	18	7518	38
7448	18	7519	38
7449	18	7520	38
7450	18	7521	38
7451	18	7522	38
7452	18	7523	38
7453	18	7524	38
7454	18	7525	38
7455	18	7526	38
7456	18	7527	38
7457	18	7528	38
7458	18	7529	38
7459	18	7530	38
7460	18	7531	38
7461	18	7532	38
7462	18	7533	38
7463	18	7534	38
7464	18	7535	38
7465	18	7536	3



## TTL 74LS SERIES

74LS00N	21	74LS42N	44	74LS138N	50	74LS191N	80	74LS283N	65
74LS01N	22	74LS47N	72	74LS139N	50	74LS192N	70	74LS288N	85
74LS02N	24	74LS53N	35	74LS148N	1.33	74LS193N	70	74LS348N	1.65
74LS03N	24	74LS54N	35	74LS149N	1.33	74LS194N	70	74LS362N	9.95
74LS04N	25	74LS55N	39	74LS153N	42	74LS221N	70	74LS366N	4.8
74LS05N	25	74LS56N	39	74LS155N	64	74LS240N	99	74LS366N	4.8
74LS08N	25	74LS58N	69	74LS157N	44	74LS241N	99	74LS367N	4.8
74LS09N	25	74LS59N	32	74LS159N	44	74LS242N	99	74LS368N	4.8
74LS10N	24	74LS60N	42	74LS160N	67	74LS243N	99	74LS373N	1.09
74LS11N	28	74LS62N	50	74LS161N	67	74LS244N	99	74LS374N	1.15
74LS12N	25	74LS63N	50	74LS163N	69	74LS245N	1.25	74LS375N	60
74LS13N	36	74LS64N	74	74LS164N	58	74LS246N	1.25	74LS377N	1.75
74LS14N	48	74LS67N	39	74LS165N	85	74LS253N	55	74LS378N	99
74LS20N	29	74LS121N	35	74LS166N	1.49	74LS257N	55	74LS390N	1.44
74LS21N	27	74LS122N	35	74LS167N	1.49	74LS259N	1.24	74LS393N	9.9
74LS26N	25	74LS123N	67	74LS173N	44	74LS262N	99	74LS394N	9.9
74LS30N	29	74LS125N	49	74LS174N	44	74LS273N	99	74LS624N	1.68
74LS32N	27	74LS132N	55	74LS175N	45	74LS279N	44	74LS670N	1.26
74LS38N	28	74LS133N	49	74LS189N	3.48	74LS280N	1.96		

## TTL 74F SERIES

FAIRCHILD ADVANCED SCHOTTKY

74F00PC	.96	74F64PC	.96	74F182PC	3.30	74F353PC	2.34
74F02PC	.96	74F74PC	1.16	74F241PC	4.50	74F373PC	5.85
74F04PC	1.11	74F138PC	2.16	74F243PC	5.25	74F379PC	3.36
74F08PC	.96	74F153PC	2.16	74F252PC	2.34	74F381PC	7.65
74F10PC	.96	74F155PC	1.83	74F257PC	2.34	74F390PC	4.40
74F11PC	.96	74F157PC	2.16	74F258PC	2.34	74F399PC	2.64
74F20PC	.96	74F158PC	2.16	74F283PC	3.40	74F521PC	4.25
74F32PC	.96	74F159PC	1.98	74F352PC	2.34	74F534N	5.85

## 9300 SERIES TTL

9300PC	.79	9309PC	1.56	9324PC	.84	9370PC	2.45
9301PC	1.35	9312PC	.79	9324PC	2.45	9374PC	2.45
9308PC	1.75	9316PC	1.65	9368PC	2.39	93L16PC	2.50
						93S16PC	2.95

## CMOS

4001	.26	4020	.89	4043	.79	4073	.26	4512	.82
4002	.26	4021	.75	4047	.92	4075	.28	4514	1.79
4006	.89	4022	.89	4049	.50	4076	.85	4515	1.79
4009	.46	4023	.26	4051	.90	4077	.26	4518	.79
4010	.42	4024	.69	4052	.95	4078	.26	4520	.80
4011	.26	4025	.25	4053	.95	4079	.28	4528	.99
4012	.25	4027	.55	4060	.89	4082	.28	4532	1.05
4013	.49	4028	.70	4066	.65	4093	.65	4556	.65
4015	.78	4029	.85	4068	.30	4104	2.99	4555	.70
4016	.45	4030	.58	4075	.25	4105	.89	4560	.73
4017	.75	4035	.89	4076	.26	4510	.84	4568	.73
4018	.75	4040	.88	4077	.26	4511	.85	4570	8.96
4019	.62	4042	.75	4078	.26				

SPECIAL OFFER — 10% DISCOUNT ON \$100 ORDER OF CMOS  
15% DISCOUNT ON \$250 ORDER OF CMOS

ACTIVE ELECTRONICS IS A DIVISION OF FUTURE ELECTRONICS, ONE OF THE WORLD'S LARGEST FRANCHISED DISTRIBUTORS. WE ARE THE SOURCE, THE UNIQUE SUPPLIER OF FACTORY FRESH, TOP QUALITY CURRENT PRODUCTION MATERIAL. OVER \$40 MILLION IN STOCK.

## LINEAR IC'S

301ATC	.32	358TC	.44	741PC	.48	3302PC	.69
308TC	.59	380PC	.44	741TC	.29	3403PC	.96
309KC	1.25	393TC	.49	747PC	.50	3900PC	.59
311TC	.48	405TC	.75	148TC	.32	4136PC	.88
317KC	1.25	566PC	.64	1488PC	.78	4151TC	.96
317UC	1.25	567TC	.80	1489APC	.68	4558TC	.44
318TC	1.25	709HC	.48	220TC	3.19	N8726N	1.36
323KC	3.96	723PC	1.25	220TC	2.89	AM26LS31CN	2.25
324PC	.48	725TC	1.25	2240PC	1.39	AM26LS32CN	2.25
337UC	1.65	733PC	.79	3081PC	1.09	ULN2002AN	.96
339PC	.45	741HC	.64	3086PC	.59		

KC=TO3, UC=TO220, HC=TO5, TC=8 PIN MINI DIP, N or PC=DUAL IN LINE IC

## SCR'S AND TRIACS

TIC 45	SCR	6 AMP	60V	.51
TIC 47	SCR	6 AMP	200V	.59
2N5064	SCR	8 AMP	200V	.39
TIC 106D	SCR	5 AMP	400V	.55
TIC 110D	SCR	8 AMP	400V	1.19
TIC 116S	SCR	8 AMP	500V	1.89
TIC 116M	SCR	8 AMP	600V	2.38
TIC 126D	SCR	12 AMP	400V	1.48
TIC 206D	TRIAC	3 AMP	400V	1.25
TIC 216B	TRIAC	6 AMP	200V	1.12
TIC 216D	TRIAC	6 AMP	400V	1.16
TIC 226D	TRIAC	8 AMP	400V	1.90
TIC 226E	TRIAC	8 AMP	500V	1.90
TIC 236D	TRIAC	12 AMP	400V	1.30
TIC 246D	TRIAC	16 AMP	400V	1.60
TIC 263D	TRIAC	25 AMP	400V	2.59

## SILICONIX VMOS

VN46AF	40V	15W	.98
VN66AF	60V	15W	1.28
VN88AF	80V	15W 4 OHMS	1.38
VN89AF	80V	15W 4.5 OHMS	1.28
VN10KM	60V	1W	.69
2N6657	60V	25W	4.98
2N6658	90V	25W	6.88
2N6659	35V	6.25W	4.60
2N6660	60V	6.25W	2.89
2N6661	90V	6.25W	4.44

## PLASTIC POWER TRANSISTORS

TIP 29C	.49	TIP 107	.99
TIP 30C	.50	TIP 112	.72
TIP 31C	.50	TIP 115	.72
TIP 32C	.55	TIP 117	.74
TIP 33C	.92	TIP 122	.76
TIP 34C	.99	TIP 125	.75
TIP 35C	1.89	TIP 127	.82
TIP 36C	1.97	TIP 142	1.91
TIP 41C	.68	TIP 146	1.79
TIP 42C	.78	TIP 147	2.15
TIP 47	.62	TIP 152	1.27
TIP 50	.79	TIP 161	2.48
TIP 51	1.48	TIP 620	1.54
TIP 54	1.88	TIP 2955	.82
TIP 102	.98	TIP 3055	.72

## SPECIAL POWER SCHOTTKY DIODES

SD41	30 AMPS	45 VOLTS	3.95
SD51	60 AMPS	45 VOLTS	6.95

## SCHOTTKY BARRIER DIODES

ISS97 UHF MIXER	.36
ISS98 UHF DETECTOR	.35

## VOLTAGE REGULATORS

78XXUC	TO220 CASE	Reduced	.68
78XXKC	TO3 CASE	Reduced	1.36
79XXUC	TO220 CASE	Reduced	.69
79XXKC	TO3 CASE	Reduced	1.44
78H05SC	5 VOLTS	TO3 CASE	Reduced 5.95
78H12ASC	12 VOLTS	TO3 CASE	Reduced 7.25
78H05ASC	ADJUSTABLE	TO3 CASE	Reduced 6.45
78P05SC	5 VOLTS	TO3 CASE	Reduced 9.45

## BIFETS OP-AMPS

TL071 CP	.68
TL072 CP	.96
TL074 CN	1.75
TL081 CP	.64
TL082 CP	1.75
TL084 CN	2.85
TL431 CLP	1.65
TL495 CN	.72
TL497 ACN	.45
TL604 CP	2.45
	1.25

## ACTIVE ELECTRONICS

### ANNUAL HIGH TECHNOLOGY SALE

#### STATIC RAM'S

P2016-20	16K (2K x 8)	200NS 24 PIN	9.95
P2101-25	1K (256 x 4)	250NS 22 PIN	2.65
P2102-25L	1K (1K x 1)	250NS 16 PIN LOW POWER	1.59
P2112-25	1K (256 x 4)	250NS 16 PIN	2.75
P2114-20L	4K (1K x 4)	200NS 18 PIN LOW POWER	1.89
P2114-30L	4K (1K x 4)	300NS 18 PIN LOW POWER	1.69
P2147-055	4K (4K x 1)	55NS 18 PIN	3.95
P4315-45L	4K (4K x 1)	450NS 18 PIN (CMOS) LOW POWER	4.95
C2167-070	16K (16K x 1)	70NS 20 PIN	18.50
P5516-25L	16K (2K x 8)	250NS 24 PIN (CMOS)	Reduced 14.95
P6116-15	16K (2K x 8)	150NS 24 PIN (CMOS)	Reduced 11.95
P6116-20	16K (2K x 8)	200NS 24 PIN (CMOS)	Reduced 7.95
P6514-45	4K (1K x 4)	450NS 18 PIN (CMOS)	Reduced 4.25

#### DYNAMIC RAM'S

P4050-30	4K (4K x 1)	300 NS 18 PIN	3.65
P4060-30	4K (4K x 1)	300 NS 22 PIN	3.65
P4116-15	16K (16K x 1)	150 NS 16 PIN	2.45
P4116-20	16K (16K x 1)	200 NS 16 PIN	1.40
P4116-25	16K (16K x 1)	250 NS 16 PIN	1.35
P4164-15	64K (64K x 1)	150 NS 16 PIN	Reduced 12.50
P4164-20	64K (64K x 1)	200 NS 16 PIN	Reduced 9.95

"LATEST TECHNOLOGY"

P4416-20	64K (16K x 4)	200 NS 16 PIN	25.95
----------	---------------	---------------	-------

#### EPROMS

C2708-45	8K (1K x 8)	450NS 24 PIN	6.95
C2716 / TMS2516	16K (2K x 8)	450NS 24 PIN	6.25
C2516-35	SINGLE 5V SUPPLY, INTEL PIN OUT	350NS 24 PIN	7.75
TMS2716	SINGLE 5V SUPPLY, INTEL PIN OUT	450NS 24 PIN	10.95
C2532	32K (2K x 8)	450NS 24 PIN	Reduced 9.45
C2732	32K (4K x 8)	450NS 24 PIN	Reduced 8.95
C2764-30	64K (8K x 8)	300NS 28 PIN	Reduced 28.95
C2764-45	64K (8K x 8)	450NS 28 PIN	26.95

#### BIPOLAR PROM'S

6330/82S23	32 x 8	OC 16 PIN	Reduced 1.95
6331/82S123	32 x 8	TS 16 PIN	Reduced 2.35
93417/82S126	256 x 4	OC 16 PIN	Reduced 2.35
93427/82S129	256 x 4	TS 16 PIN	Reduced 2.35
93448/6341	512 x 8	TS 24 PIN	Reduced 6.50
93453/82S137	1024 x 4	TS 18 PIN	6.50
93451/82S181	1024 x 8	TS 24 PIN	10.95
7128/27S185	2048 x 4	TS 18 PIN	Reduced 12.95
7138/28S166	2K x 8	TS 24 PIN	21.80
7142/82S321	4K x 8	TS 24 PIN	49.95

TS=TRISTATE, OC=OPEN COLLECTOR

## MICROPROCESSOR CHIP SETS

#### 6500 FAMILY

6502 CPU	6.95
6520 PIA	4.65
6522 VIA	7.95
6532 RIOT	10.85
6551 ACIA	9.95

#### 8080 FAMILY

8035	5.45	8224	2.20
8039	Reduced 8.95	8226	2.25
8080A	4.45	8228	Reduced 4.40
8085A	6.95	8251A	5.95
8086	34.95	8253	Reduced 8.45
8748	28.95	8255	Reduced 5.05
8155	9.00	8257	8.05
8212	2.25	8259A	7.50

#### 6800 FAMILY

6800 CPU	4.65
6802 CPU	7.95
6808 CPU	8.45
6809 CPU	13.95
6810 RAM	2.65
6821 PIA	2.65
6840 PTM	7.95
6845 CRTA	14.95
6850 ACIA	3.15
6852 SSDA	4.85

#### UART'S

AY3-1015A / S1602P	3.95
AY5-1013A	4.50



**\*QUALITY  
\*PRICE  
\*PERFORMANCE**

**SATELLITE**

**Tunable Audio Demodulator** — Tunes from 5.4 to 8.2 MHz. Switchable 5 KHz. LP filter for Canadian birds. Varactor tuning diodes included. Use two for MTV.

**Bare Board (M81-020B)** . . . . . \$24.95  
**Two Boards (M81-021B)** . . . . . \$39.95

**Canadian Audio Descrambler** — Takes the normal audio output from your receiver and decodes the 'chirping' sub-carriers heard on Anik A/B.

**Kit (R81-010K)** . . . . . \$59.95  
**Assembled & Tested (R81-010T)** . . \$94.95

**NEW! Canadian Audio Filter** — A very sharp low-pass filter designed to remove the 'chirping' from the Canadian audio.

**Kit (R82-020K)** . . . . . \$19.95  
**Assembled & Tested (R82-020T)** . . \$29.95

**Developed for high performance  
in weak signal areas.**

**Discrete 70 MHz PLL** — Replaces NE 564 video demodulator without the need for an ECL divider (70 MHz I.F.). Guaranteed tracking to 85 MHz. Wide bandwidth. Lower C/N, reduced 'tearing'. May be remotely tuned.

**Kit (M82-010K)** . . . . . \$124.95  
**Assembled & Tested (M82-010T)** . . \$159.95

All prices include complete and comprehensive documentation, U.S. postage & handling. For overseas postage & handling, add \$2.00.

**P.O. Box 1656  
Kodiak, Alaska 99615**  
(907) 486-5118  
(907) 486-6215



**DigiCom Engineering, Inc.**

**MOVING?**

Don't miss a single copy of **Radio-Electronics**. Give us:

Six weeks' notice

Your old address and zip code

Your new address and zip code

**ATTACH  
LABEL  
HERE**

name (please print)

address

city state zip code

**Mail to: Radio-Electronics  
SUBSCRIPTION DEPT., P.O. BOX 2520,  
BOULDER, COLO. 80322**

**ADVERTISING INDEX**

**RADIO-ELECTRONICS** does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Page	25	
37	Aaron Gavin	93	Neptune Communications, Inc.
44	Abex	95	Nesda
53	Active	135	Netronics
—	Advance Electronics	12-15	New Horizons
49	Advanced Computer Products	121	New Tone
26	Advanced Tool Technology	98	NRI Schools
15	Albia Electronics	29	NTS Schools
58	All Electronics	127	Nuts & Volts
30	AMC Sales	92	Omnitron Electronics
29	Anders Precision Instruments	91	Paia Electronics
74	Arizona Electronics	127	PC Magazine
—	ATV	106	Peterson Electronics
—	Bagnall Electronics	108	Philips Test & Measuring Instruments
—	Barta	106	PolyPaks
5	Beckman Electronics	Cover III	Pomona Electronics
70	B.G. Micro	134	PPG
—	Bullet	132	Priority One
—	C&D Electronics, Inc.	120	Quest Electronics
—	CIE, Cleveland Institute of Electronics	34-37	Radio Shack
81	Chaney Electronics Inc.	130	Ramsey Electronics
35	Command Productions	97,103	R.F. Electronics
12	Communications Electronics	2	Rhoades
80	Computer Products & Peripherals Unlimited	120	RJN Electronics
—	Components Express	91	Sams Books
60	Consolidated Electronics, Inc.	108	Satellite TV
65	Concord	134	SCR
—	Cook's Institute	103	SEI
90	CRT	95	Simple Simon Electronics
—	Dage	108	Sintec
21	Data Precision	22	SJB
—	Devtronix	106,108	SMP
72	Diamondback	114	Solid State Sales
—	DigiCom Engineering	136	Spartan Electronics
48	Digi-Key Corp.	128-129	Sperry A.W.
28	Digitron Electronics	93	Stavis Electronics
55	Dokay	111	Stevens Products
43	DX Tele Labs	95	Suntronics Co., Inc.
85	Eastern Enterprises, Inc.	126	Suntronix
—	EduCalc	97	Symmetric Sound Systems
88	Electronic Rainbow Inc.	26,40	Tektronix
32	Electronic Specialists, Inc.	98	Triplett
38	Enterprise Development Corp.	99	Triton
56	Etco Electronics	107	Ungar
36	Etronix	97	Video Sales
6	Fluke	5	Viking Phone Co.
—	Fordham Radio	85	VIZ Mfg. Co.
45	Formula International	124-125	Wersi Electronics
—	Galaxy Electronics	103	Wheeler Electronics
68	Gilco International Inc.	110	Wm. B. Allen
91	Gillespie & Associates	33	Zenith Radio Co.
31	Gladstone Electronics	102	Cover IV
10	Global Specialties Corp.	42	
—	Grantham College of Engineering	102	
87	Hal Communications Corp.	24	
—	Hallbar	133	
34	Haltronix	134	
3	Heath	68-71	
97	Hickok	96	
83	Information Unlimited	133	
39	International Crystal	96	
98	International Publishing & Software	101	
47	Jameco Electronics	112-113	
46	JDR Microdevices	116-119	
—	J&W Electronics	108	
19	Keithley Instruments	41	
7	Kikusui International Corp.	Cover II	
67	Knapp	122	
63	M/A Com.	133	
—	McGee's Radio	104	
84	MFJ Enterprises	104	
27	Micromanagement Systems, Inc.	95	
—	Microtenna	108	
66	Mikos	132	
—	Monarchy Engineering, Inc.	114	
82	Mountain West Alarm	122	
76	MP Systems	104	
42	Nationwide	95	

**MICROWAVE HORN ANTENNA KIT**

1.7-26 GHz Frequency Range 17-19 lb Gain Kit w/Assembly Instructions \$39.95\*  
Down Converter Board \$19.95\* (w/Antenna Kit \$14.95)  
Parts Kit for Board \$29.95\* (w/Antenna or Board \$24.95)  
COMPLETELY ASSEMBLED AND TESTED SYSTEM \$129.95  
(including power supply and cabling)  
2.1 to 2.6 GHz Ant. - 34 db Gain (or greater)



**MICROTEENNA ASSOCIATES**

2335 South 2300 West, Salt Lake City, Utah 84119  
Check or M.O. only — Allow 2-4 Weeks Delivery (Cost includes shipping)  
\*Utah Residents Please Add 5% Sales Tax

**BUY DIRECT**

Twice the gain of a Mitsumi

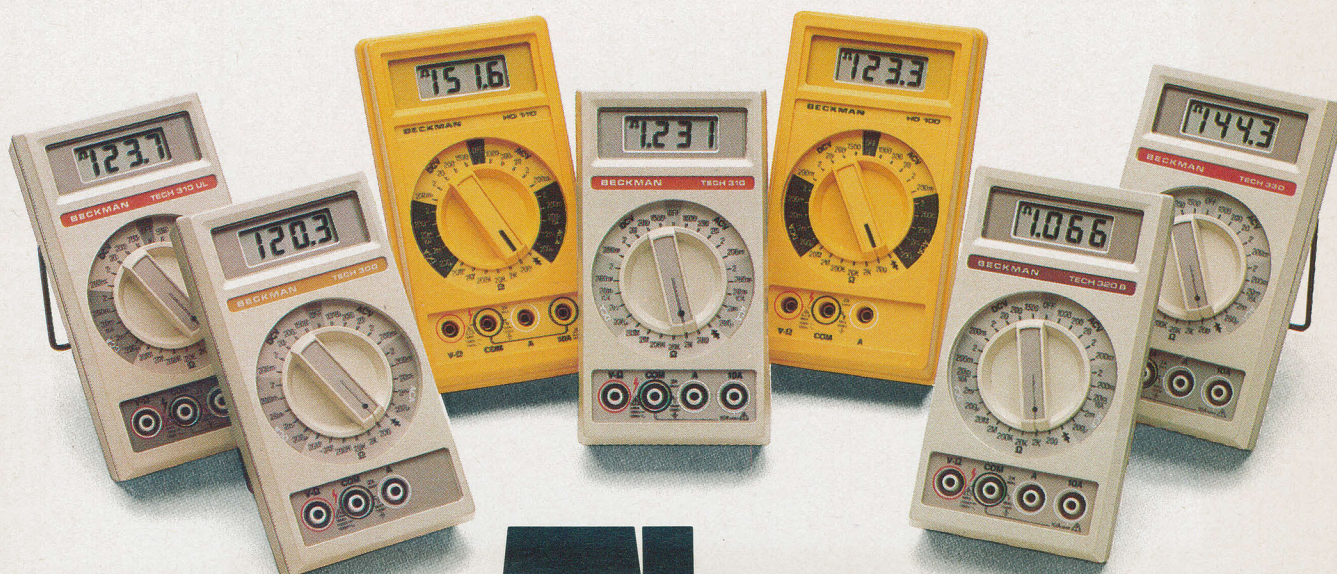
PHILLIPS UHF VARACTOR TUNERS  
UHF 470-889 MHZ: 75 ohm input  
Channel 14-83: Output Channel 3  
ELC-1045 \$22.50 ea./lots of 10 \$21.00  
Carton of 50 .....\$19.00 each

**TRANSFORMERS**

117v.pri. to 23v.Sec. at 450 Ma.  
\$3.00 ea./Carton of 48..\$2.25 ea.  
10 cartons (480 total)up \$2.00 ea.  
10 TURN POTS CTS,500 ohm,5K,10K  
\$4.00 ea. /10-\$3.50 ea./50-up \$3.00

**ELECTRONIC SUPPLIES CENTER** PHONE 929-0708  
2147 W BELMONT AVE Send Check or Money Order. Minimum  
CHICAGO, ILLINOIS 60618 Order: \$16.95. Add 10% Shipping and Handling





# The Workaholics.

Beckman DMMs stay on the job when others call it quits. They're a hard-nosed breed of 3½ digit hand-held multimeters you can always count on for outstanding performance.

## Staying power

Beckman DMMs work up to 2000 hours on a common 9V battery. That's ten times longer than other DMMs. And to prevent burnout on the job, Beckman DMMs can withstand 1500 Vdc loads and 6kV transients. Current ranges are protected with a 2A/250V fuse, and resistance ranges are protected up to 500 Vdc.

## Easy to work with

No matter how hard they work, they're never hard to work with. Their single rotary switch makes function and range selection simple and sure. For your added convenience, most Beckman DMMs have built-in 10-Amp capacity and Insta-ohms® continuity indication. That means you never have to carry an accessory shunt or wait for a continuity check.

## SELECTION CHART

MODEL	SPECIAL FEATURES	BASIC DC ACCURACY	INSTA-OHMS®	10 AMPS	SUGGESTED RETAIL PRICE (U.S.)
Tech 300	Basic six functions	0.5%			\$120
Tech 310	Added features	0.25%	✓	✓	145
Tech 310UL	UL-listed	0.25%	✓	✓	155
Tech 320B	Audible continuity beeper	0.1%	✓	✓	189
Tech 330	High accuracy & true RMS (AC & DC)	0.1%	✓	✓	219
HD-100	Heavy duty (drop-proof, contamination-proof)	0.25%	✓		169
HD-110	Heavy duty, plus 10 Amps	0.25%	✓	✓	189

And to make sure that the job is done right the first time, Beckman DMMs have superior RF shielding, and an impressive 22 Meg-ohm input impedance that reduces circuit loading to ensure accurate readings.

No matter how much the job demands, you can count on Beckman DMMs to see you through.

There's a Beckman DMM just right for every application. Use the selection chart to find the model best for you.

For a closer look at the workaholics, see your local Beckman distributor today. To locate the one nearest you, call or write Beckman Instruments, Inc., Instrumentation Operations, 210 S. Ranger Street, Brea, CA 92621. (714) 993-8803.

# BECKMAN



# Don't touch that connection!

**New Zenith push-button VIDEO ORGANIZER permits switching from one program source to another without changing cable connectors. Lets you select up to six different program sources for viewing. Up to three different sources for recording. Even lets you view one program source while simultaneously recording another. All this without changing cable connections!**



Model S10W

At last the nuisance of manually changing cable connections is a thing of the past!

With Zenith's new Video Organizer, separate input and output jacks enable you to make a complete connection of TV and VHF antenna or cable TV antenna, subscription TV decoder, video disc player, video cassette recorder, video game and home computer or other auxiliary video equipment.

So you switch from one program

source to another with pushbutton ease – without changing connections.

Equally important, the Video Organizer's advanced engineering design by Zenith results in low insertion loss and high isolation. Eliminates electromagnetic interference for maximum picture quality. And permits greater flexibility in use and ease of operation for more hours of uninterrupted home video enjoyment.

Write now for more information.

